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AN ANNOTATED BIBLIOGRAPHY ON THE BIOLOGY OF PACIFIC TUNAS

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AN ANNOTATED BIBLIOGRAPHY ON THE BIOLOGY OF PACIFIC TUNAS

BY BELL M. SHIMADA, *Fishery Research Biologist*

Studies were begun in 1948 by the Pacific Oceanic Fishery Investigations of the U. S. Fish and Wildlife Service to gather fundamental data on the life histories, ecology, and behavior of the various species of Pacific tunas. Early in the planning of the research program conducted from the Hawaiian Islands, it was recognized that review and systematic compilation of the literature on these subjects were essential to the effective guidance of the projected research. The principal reference work available was the bibliography of the tunas prepared some 20 years ago by Genevieve Corwin (see Corwin 1930, in the Bibliography, p. 5). To meet the needs of the workers in the Investigations, and to assist tuna researchers in general, the preparation of this bibliography was undertaken.

The bibliography deals chiefly with the black skipjacks or little tunnies (*Euthynnus alletteratus*, *E. lineatus*, and *E. yaito*), the oceanic or common skipjack (*Katsuwonus pelamis*), the albacore (*Thunnus germon*), the bluefin or black tunas (*Thunnus maccoyii*, *T. orientalis*, and *T. thynnus*), the big-eyed tunas (*Parathunnus mebachi* and *P. sibi*), the yellowfin tuna (*Neothunnus macropterus*), and the frigate mackerels of the genus *Axiis*. Synonymous and related species reported from the Pacific Ocean are included. Waters contiguous to the Indo-Australian Archipelago have been considered as a part of the Pacific Ocean proper, inasmuch as many of the important studies of tuna species occurring in the Pacific Ocean were based on data gathered in that region.

In the review of the literature, some preliminary work was done at Stanford University, Palo Alto, and at the California Academy of Sciences, San Francisco, California. The libraries of the Bernice Pauahi Bishop Museum, the University of Hawaii, and the Territorial Board of Agriculture and Forestry in Honolulu, and private collections of staff members of the Investigations were particularly

productive of material. The Japanese references were gathered by a reconnaissance team in Japan from November 1948 to July 1949 investigating the results of Japanese tuna research. Search of private and public libraries in and about Tokyo supplied much material that has not hitherto been generally available outside Japan. Some references found in Corwin's bibliography could not be examined at first hand; these are included here, as given by Corwin, with a notation to show their source.

The general style used by Corwin has been followed in cataloging and annotating the material. The arrangement of the references is by authors listed alphabetically. Entry is made only under the senior author's name if there is more than one author; the abbreviation "et al." is used with the senior author's name to show collaboration of more than three authors. Each author's works are listed chronologically by year of publication, and those published in the same year are given in alphabetical sequence. Generally, pagination is given only for the parts of the publication falling within the scope of the bibliography.

Appropriate notations in the bibliography distinguish those papers published only in Japanese, those published in Japan but written in English, and those published in Japanese with an English abstract. Translations were made of Japanese titles when English equivalents were not given.

Brief annotations of the publications are included except for those that could not be consulted and for those whose titles give a clear indication of the contents. The scientific nomenclature used by each author is followed in the annotations; appropriate cross references to synonymous names regarded as having priority appear in the Index. Where both vernacular and scientific names of the tuna were given, the scientific nomenclature is retained.

The preparation of the Index presented considerable difficulty owing to the confused state of the

taxonomy of the various species of tuna. As the relationships of the tuna species of the Pacific, and for that matter the world in general, have not been clearly defined, specific names of questionable validity have been arbitrarily indexed as separate entries. For example, *Neothunnus itosibi* is regarded by some workers as a form distinct from *Neothunnus macropterus*, while others consider the two to be synonymous. References to *Neothunnus itosibi* and *Neothunnus macropterus*, therefore, have been treated separately. Synonyms which are generally accepted as applying to one given species, such as *Euthynnus pelamis* for *Katsuwonus pelamis*, have been indexed under the name which is believed to have priority, with appropriate cross reference under the synonymous name. The same procedure was used in indexing names which differ slightly in spelling. Again, it should be pointed out that the indexing of these scientific names is to a large degree arbitrary, and is not an attempt to clarify the systematics of the tunas.

A list of abbreviations of the various publications cited and of the English translations of titles of Japanese periodicals as used in the bibliography is included.

Acknowledgment is made of the valuable assistance and advice given the author by various individuals and organizations. Especially is credit due the Fisheries Division, Natural Resources Section, General Headquarters, Supreme Commander for the Allied Powers, under W. C. Herrington, Drs. K. Kuroshima and Y. Hiyama, and other Japanese scientists, and Dr. J. G. F. Hardenburg of Batavia, Java, for their generous cooperation. The author is also indebted to the library staffs of Stanford University, the California Academy of Sciences, University of Hawaii, and the Bernice Pauahi Bishop Museum, and to Vernon Brock of the Division of Fish and Game, Board of Agriculture and Forestry, Territory of Hawaii, and staff members of the Pacific Oceanic Fishery Investigations, who contributed materially to the preparation of this bibliography.

ANNOTATED BIBLIOGRAPHY

Explanation of symbols

- [C]=references listed by Corwin (see Corwin 1930, p. 5) that could not be verified.
 [J]=published in Japanese only.
 [JE]=published in Japan but written in English.
 [Je]=written in Japanese with English abstract.
 [P]=accession to the library of the Pacific Oceanic Fishery Investigations.

[For an explanation of the abbreviation see Itst, p. 25]

ABE, TOKIHARU.

1939. A list of the fishes of the Palao Islands. Palao Trop. Biol. Sta. Studies, No. 4, p. 567. [JE] [P]
Germo macropterus, *Katsuwonus pelamis*, *Thunnus thynnus*: recorded; distribution.

AIKAWA, HIROAKI.

1933. Fishery conditions on the Pacific Coast for skipjack, tuna, and sauries. Proc. Sci. Fish. Assoc., vol. 5, No. 4, pp. 354-369. [J] [P]
 Albacore, big-eyed tuna, black tuna, skipjack, yellowfin tuna: fishing conditions correlated with surface water temperature.
 1937. Notes on the shoal of bonito along the Pacific Coast of Japan. Bull. Japanese Soc. Sci. Fish., vol. 6, No. 1, pp. 13-21. [Je] [P]
 Age analysis and size composition of skipjack catches; stock and population relationships; use of condition factor in separating migratory and nonmigratory fish.

AIKAWA, HIROAKI, and MASAO KATO.

1938. Age determination of fish. I. Bull. Japanese Soc. Sci. Fish., vol. 7, No. 2, pp. 79-88. [Je] [P]
Germo germo, *Katsuwonus vagans*, *Neothunnus macropterus*, *Thunnus orientalis*: age analysis using vertebrae; age composition of commercial catch; calculated length and weight groups; body condition; growth rate; morphometric data.

ANONYMOUS.

1938. Status of the investigation of tuna longline fishing grounds in the South China Sea. Formosa Fish. Mag., No. 279, pp. 10-19. [J]
 Albacore, yellowfin tuna: body temperatures; distribution; length-weight data; sexual maturity; stomach contents; figured.
 1939. Marked fish. Semi-Ann. Rpt. Oceanogr. Invest., No. 65, p. 137. [J]
 Skipjack: Japan; release records of tagged fish.
 1941. Pacific skipjack indigenous to Sulu Sea. South Sea Fish., vol. 7, No. 5, p. 55. [J] [P]
 Distributional note.

ASANO, NAGAO.

1939. Food of the albacore, *Germo germo* (Lacépède). South Sea Fish. News, vol. 3, No. 7, pp. 10-11. [J] [P]
 South Seas; stomach contents; *Auaxis* sp. recorded as food.

BAN, YOSHINORI.

1941. Search for southern tuna fishing grounds. South Sea Fish., vol. 7, No. 9, pp. 10-21. [J] [P]
 Yellowfin tuna: South Seas; fishing conditions correlated with oceanography; stomach contents; age analysis; sexual maturity.

BARNHART, PERCY.

1936. Marine fishes of Southern California. Univ. California Press, Berkeley, pp. 36-37.
Auaxis thazard, *Katsuwonus pelamis*, *Germo alalunga*, *Neothunnus macropterus*, *Thunnus thynnus*: description; distribution; English common names; figures.

BENNETT, FREDERICK DEBELL.

1840. Narrative of a whaling voyage around the globe, from the year 1833 to 1836. Vol. 2, pp. 278-282. London.
Scomber germo: description; anatomy of reproductive system; food; enemies. *Scomber pelamys*: description; parasites.

BERG, LEO S.

1947. Classification of fishes both recent and fossil. J. W. Edwards Co., Ann Arbor, pp. 491-492.
 Anatomy and classification of Thunniformes (Plecosteii).

BLEEKER, PIETER.

1844. Bijdragen tot de geneeskundige topographie van Batavia. Generisch overzicht der fauna. Nat. Geneesk. Arch. Neerland's Indië, vol. 1, p. 553.
Thynnus: recorded.
 1845. Bijdragen tot de geneeskundige topographie van Batavia. Generisch overzicht der Fauna. Nat. Geneesk. Arch. Neerland's Indië, vol. 2, p. 516.
Auaxis taso: recorded.
 1850. Bijdrage tot de kennis der ichthyologische fauna van Midden-en Oost-Java, met beschrijving van eenige nieuwe species. Verh. Batavia Genoot. Kunst. Wetens., vol. 23, p. 8.
Auaxis taso: recorded.
 1852. Bijdrage tot de kennis der makreelachtige visschen van den Soenda-Molukschen Archipel. Verh. Batavia Genoot. Kunst. Wetens., vol. 24, pp. 36-37, 89.
Thynnus macropterus, *T. thunnina*, and *T. tonggol*: recorded from Dutch East Indies; description and synonymy of *T. tonggol*.

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1854. Faune ichthyologicae japonicae species novae. Nat. Tijdschr. Nederlandsch-Indie, vol. 6, pp. 408-409.
Auxis tapeinosoma: recorded and described.
1855. Vijfde bijdrage tot de kennis der ichthyologische fauna van Ternate. Nat. Tijdschr. Nederlandsch-Indie, vol. 8, pp. 301-302.
Auxis thynnoides: recorded; description; compared with *A. tapeinosoma*, *A. taso*, and *A. vulgaris*.
1856. Beschrijvingen van nieuwe en weinig bekende vischsoorten van Amboina, versameld op eene reis door den Molukschen Archipel, gedaan in het gevolg van den Gouverneur-Generaal Duymaer van Twist in September en October 1855. Act. Soc. Sci. Indo-Neerlandicae, vol. 1, pp. 41-42.
Thynnus pelamys: recorded; description; synonymy.
1857. Nieuwe nalezingen op de ichthyologie van Japan. Verh. Batavia Genoot. Kunst. Wetens., vol. 26, p. 98.
Auxis tapeinosoma: recorded.
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Thynnus pelamys, *T. thunnina*: recorded from the Dutch East Indies.
- 1860b. Dertiende bijdrage tot de kennis der vischfauna van Celebes. Visschen van Bonthain, Badjoa, Sindjai, Lagoesi en Pompenoea. Act. Soc. Sci. Indo-Neerlandicae, vol. 8, p. 38. [C]
Thynnus thunnina: recorded from Dutch East Indies.
- 1861a. Iets over de vischfauna van het eiland Pinang. Versl. Akad. Amsterdam, vol. 12, p. 74.
Thynnus affinis: recorded from Dutch East Indies.
- 1861b. Mededeeling omtrent vischsoorten, nieuw voor de kennis der fauna van Singapoera. Versl. Akad. Amsterdam, vol. 12, p. 52. [C]
Thynnus thunnina, *T. tonggol*: recorded from Singapore.
1862. Sixième mémoire sur la faune ichthyologique de l'île Batjan. Versl. Akad. Amsterdam, vol. 14, p. 109.
Pelamys macropterus, *P. pelamys*, *Thynnus thunnina*: recorded from Dutch East Indies.
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- 1865a. Énumération des espèces de poissons actuellement connues de l'île d'Amboine. Nederlandsch Tijdschr. Dierk., vol. 2, p. 285.
Auxis thynnoides, *Pelamys macropterus*, *P. pelamys*, *P. thunnina*: recorded.
- 1865b. Sixième notice sur la faune ichthyologique de Siam. Nederlandsch Tijdschr. Dierk., vol. 2, p. 173. [C]
Thynnus thunnina: recorded.
1878. Quatrième mémoire sur la faune ichthyologique de la Nouvelle-Guinée. Arch. Néerlandaises Sci. Nat., vol. 13, p. 50.
Auxis taso: recorded.

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Pelamys sibi Bkr. and *Thynnus sibi* Schl. compared.
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Thynnus macropterus, *T. orientalis*, *T. pelamys*, *T. sibi*, *T. thunnina*: description; synonymy.
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Thynnus thynnus: recorded.
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1943. Contribution to the biology of the albacore (*Germo alalunga*) of the Oregon coast and other parts of the North Pacific. Stanford Ichth. Bull., vol. 2, No. 6, pp. 199-248.
Age and size composition; growth; spawning; sex ratio; length-frequency data; population analysis.
1949. A preliminary report on *Parathynnus sibi* in Hawaiian waters and a key to the tunas and tuna-like fishes of Hawaii. Pacific Sci., vol. 3, No. 3, pp. 271-277.
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Japan; albacore and skipjack fishing conditions correlated with water temperature.
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Germo germo, *Thunnus alalunga*: migration.
- COOPER, JAMES GRAHAM.
1863. On new genera and species of Californian fishes. Proc. California Acad. Sci., vol. 3, pp. 75-77.
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1930. A bibliography of the tunas. California Div. Fish and Game, Fish Bull. No. 22, pp. 1-103.
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Germo alalunga: recorded.
- CRAIG, JOE ALLEN.
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Euthynnus pelamis, *Germo germo*, *Neothunnus catalinae*, *Thunnus saliens*: listed.
- CUVIER, GEORGES, and ACHILLES VALENCIENNES.
1831. Histoire naturelle des poissons. Vol. 8, pp. 85, 96, 107. Paris.
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Euthynnus alletteratus, *E. pelamys*, *Neothunnus macropterus*, *N. rarus*: description; distribution; key; Malayan common names; spawning of *E. alletteratus* and description of eggs and larvae; spawning of *N. rarus* and description of eggs; food of *E. pelamys*; *E. alletteratus* and *N. macropterus* figured.
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1940. Tuna fishing in Southern Mindanao. Philippine Jour. Sci., vol. 73, No. 4, pp. 423-435.
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1949a. Fishery exploration in the Hawaiian Islands (August to October 1948, by the vessel Oregon of the Pacific Exploration Company). Com. Fish. Rev., vol. 11, No. 6, pp. 1-9.

Euthynnus yaito, *Katsuwonus pelamis*, *Neothunnus macropterus*: recorded; *K. pelamis* and *N. macropterus* figured.

1949b. Observations on juvenile oceanic skipjack (*Katsuwonus pelamis*) from Hawaiian waters and sierra mackerel from the Eastern Pacific. U. S. Fish and Wildlife Serv. Fish. Bull., vol. 51, No. 48, pp. 245-250.

Katsuwonus pelamis: anatomy, descriptions, figures, and records of capture of juveniles; spawning; juveniles noted in stomachs of adults.

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1891. A catalogue of the fishes of the Pacific coast of America north of Cerros Island. Ann. New York Acad. Sci., 1891-1892, vol. 6, p. 352.

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Gymnosarda pelamis: listed; synonymy.

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Auxis thazard, *Euthynnus*, *Germo alalunga*, *Katsuwonus pelamis*, *Neothunnus macropterus*, *Thunnus thynnus*: distribution; English common names; synonymy of *K. pelamis*, *G. alalunga*, *T. thynnus*; air bladders of *G. alalunga*, *N. macropterus* and *T. thynnus* described; Japanese common names of *Euthynnus* and *T. thynnus*; vertical distribution of *Parathunnus mebachi* noted.

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FORMOSA GOVERNMENT-GENERAL FISHERIES EXPERIMENT STATION.

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Formosa; fishing conditions correlated with water temperature, specific gravity, and currents.

1931. Northern oceanographic conditions and skipjack fishing. Prog. Rpt. Formosa Govt.-Gen. Fish. Expt. Sta. for 1929, Oceanogr. Sec., pp. 28-30. [J] [P]

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1932. Northern oceanographic conditions and skipjack fishing. Prog. Rpt. Formosa Govt.-Gen. Fish. Expt. Sta. for 1930, Oceanogr. Sec., pp. 10-11. [J] [P]

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Germo sibi: figured; description.

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Auxis thazard, *Euthynnus alletteratus*, *E. pelamis*, *Germo albacores*, *G. alalunga*, *G. macropterus*, *G. sibi*, *Thunnus thynnus*: description; synonymy; figures of *E. alletteratus* and *G. sibi*.

FOWLER, HENRY W.—Continued

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Germo sibi, *Thunnus thynnus*: seen in Japan.

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 Big-eyed tuna, skipjack, yellowfin tuna: Ryukyu Islands; catches correlated with water temperature.
- 1927a. Experimental longline fishing for tuna. Prog. Rpt. Kagoshima Pref. Fish. Sta. for 1925, pp. 38-53. [J] [P]
 Albacore, big-eyed tuna, black tuna, yellowfin tuna: Ryukyu Islands; catches correlated with water temperature.
- 1927b. Experimental skipjack fishing. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1925, pp. 1-38. [J] [P]
 Ryukyu Islands; skipjack fishing conditions correlated with water temperature and currents; length-weight and girth data; records and descriptions of scombroid juveniles (also reported in Kishinouye 1926).
- 1928a. Experimental skipjack fishing. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1926, pp. 1-22. [J] [P]
 Ryukyu Islands; skipjack catch correlated with water temperature and currents; length-weight and girth data; release records of tagged fish.
- 1928b. Experimental longline fishing for tuna. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1926, pp. 22-37. [J] [P].
 Albacore, big-eyed tuna, black tuna, yellowfin tuna: Ryukyu Islands; catches correlated with water temperature.

KAGOSHIMA PREFECTURAL FISHERIES EXPERIMENT STATION—Continued

1929a. Experimental skipjack fishing. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1927, pp. 1-20. [J] [P]

Ryukyu Islands; skipjack catch correlated with water temperature; length-weight and girth data.

1929b. Experimental longline fishing for tuna. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1927, pp. 20-34. [J] [P]

Big-eyed tuna, yellowfin tuna: Ryukyu Islands; catches correlated with water temperature.

1930a. Experimental skipjack fishing. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1928, pp. 1-18. [J] [P]

Ryukyu Islands; skipjack catch correlated with water temperature.

1930b. Experimental longline fishing for tuna. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1928, pp. 18-31. [J] [P]

Albacore, big-eyed tuna, yellowfin tuna: Ryukyu Islands; catches correlated with water temperature.

1930c. Experimental fishing by small motor vessels: Experimental longline fishing for albacore. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1928, pp. 54-60. [J] [P]

Albacore, big-eyed tuna, black tuna, yellowfin tuna: Ryukyu Islands; catches correlated with water temperature.

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Ryukyu Islands; skipjack catch correlated with water temperature.

1931b. Experimental longline fishing for tuna. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1929, pp. 16-30. [J] [P]

Albacore, big-eyed tuna, yellowfin tuna: Ryukyu Islands; catches correlated with water temperature.

1932a. Experimental skipjack fishing. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1930, pp. 1-20. [J] [P]

Ryukyu Islands; skipjack fishing conditions correlated with water temperature.

1932b. Experimental longline fishing for tuna. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1930, pp. 21-28. [J] [P]

Albacore, big-eyed tuna, black tuna, yellowfin tuna: Ryukyu Islands; catches correlated with water temperature.

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Ryukyu Islands; albacore catch correlated with water temperature.

KAGOSHIMA PREFECTURAL FISHERIES EXPERIMENT STATION—Continued

1933a. Investigation of skipjack fishing. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1931, pp. 1-16. [J] [P]

Ryukyu Islands, Philippine region; skipjack fishing conditions correlated with water temperature.

1933b. Experimental longline fishing for tuna. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1931, pp. 16-23. [J] [P]

Albacore, big-eyed tuna, yellowfin tuna: Ryukyu Islands; catches correlated with water temperature.

1935. Investigation of skipjack fishing. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1933, pp. 1-12. [J] [P]

Ryukyu Islands; skipjack fishing conditions correlated with water temperature.

1936a. Investigation of skipjack fishing. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1934, pp. 1-16. [J] [P]

Ryukyu Islands; skipjack fishing conditions correlated with water temperature; length-weight data.

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Ryukyu Islands; release records of tagged skipjack.

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Ryukyu Islands; skipjack catch correlated with water temperature; length-weight data; size composition of catch.

1938a. Investigation of skipjack fishing. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1936, pp. 1-4. [J] [P]

Ryukyu Islands; skipjack length-weight data.

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Ryukyu Islands; release records of tagged skipjack.

1939a. Investigation of skipjack fishing. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1937, pp. 1-3. [J] [P]

Ryukyu Islands; skipjack length-weight data.

1939b. Investigation of the migration of important fishes. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1937, p. 69. [J] [P]

Ryukyu Islands; release records of tagged skipjack.

1940a. Experimental skipjack fishing. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1938, pp. 1-3. [J] [P]

Ryukyu Islands; skipjack length-weight data.

1940b. Investigation of the migration of important fishes. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1938, p. 43. [J] [P]

Ryukyu Islands; release records of tagged skipjack.

- KAGOSHIMA PREFECTURAL FISHERIES EXPERIMENT STATION—Continued
1941. Investigation of skipjack fishing. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1939, pp. 1-3. [J] [P]
Ryukyu Islands; skipjack length-weight data.
- KANAMURA, MASAMI, and KAKUJI IMAIZUMI.
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- KANAMURA, MASAMI, and HARUO YAZAKI.
- 1940a. Report on experimental fishing by the Shonan Maru in 1937: Investigation of tuna longline fishing grounds in the East Philippine Sea. Formosa Govt.-Gen. Fish. Expt. Sta. Publ., No. 21, pp. 1-65. [J] [P]
Albacore, big-eyed tuna, skipjack, yellowfin tuna: catch per unit of effort; distribution of yellowfin, big-eyed tuna, and skipjack; yellowfin tuna: stomach contents; body temperature and relation to water temperature; length-weight data; body condition; age analysis; sexual maturity; fishing conditions in relation to oceanography and weather.
- 1940b. Report of the investigation of fishing grounds by the Shonan Maru in 1937: Investigation of tuna longline fishing grounds in the South China Sea. Formosa Govt.-Gen. Fish. Expt. Sta. Publ., No. 21, pp. 67-117. [J] [P]
Albacore, skipjack, yellowfin tuna: distribution; catch per unit of effort; fishing conditions in relation to oceanography and weather; albacore, yellowfin tuna: stomach contents; body temperature; length-weight data; body condition; age analysis; sexual maturity.
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- KAWAMURA, HYŌZŌ.
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Pacific Ocean; distribution; migration; catch correlated with water temperature; age and size composition of commercial catches.
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Japan; catches of albacore and skipjack correlated with surface water temperature.
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Albacore, big-eyed tuna, skipjack, yellowfin tuna: stomach contents; juvenile albacore, big-eyed tuna, skipjack, and *Auwis maru* recorded from stomachs of adults.
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Distribution record.

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- KITAHARA, T.
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Japan; skipjack fishing conditions correlated with oceanographic factors.
- 1923b. Oceanographic observations and search for tuna fishing grounds. Prog. Rpt. Kōchi Pref. Fish. Expt. Sta. for 1921, pp. 5-15. [J] [P]
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ABBREVIATIONS USED

- A. Hancock Pacific Exped.—Allan Hancock Pacific Expeditions. Los Angeles.
- Acad. Nat. Sci. Phila., Monogr.—Academy of Natural Sciences of Philadelphia, Monographs, Philadelphia.
- Act. Soc. Sci. Indo-Neerlandicae—Acta Societatis Scientiarum Indo-Neerlandicae. Batavia.
- Ann. and Mag. Nat. Hist.—The Annals and Magazine of Natural History. London.
- Ann. New York Acad. Sci.—Annals of the New York Academy of Sciences. New York.
- Ann. Rpt. Laguna Mar. Lab.—Annual Report of the Laguna Marine Laboratory. Claremont, California.
- Annot. Zool. Jap.—Annotationes Zoologicae Japonenses. Tokyo.
- Arch. Neerlandaises Sci. Nat.—Archives Neerlandaises des Sciences Exactes et Naturelles. Haarlem.
- Australian Zool.—The Australian Zoologist. Sydney.
- Bernice P. Bishop Mus. Occas. Papers—Bernice Pauahi Bishop Museum. Occasional Papers. Honolulu.
- Biblio. Nederlandsch Indische Nat. Ver.—Bibliotheek van de Nederlandsch Indische Natuurhistorische Vereeniging. Batavia.
- Biol. Bull. St. John's Univ.—Biological Bulletin of St. John's University. Shanghai.
- Bull. American Mus. Nat. Hist.—Bulletin of the American Museum of Natural History. New York.
- Bull. Bernice P. Bishop Mus.—Bulletin. Bernice Pauahi Bishop Museum. Honolulu.
- Bull. Biogeog. Soc. Japan—Bulletin of the Biogeographical Society of Japan. Tokyo.
- Bull. U. S. Bur. Fish.—Bulletin of the Bureau of Fisheries. United States Department of Commerce and Labor. Washington.
- Bull. Japanese Soc. Sci. Fish.—Bulletin of the Japanese Society of Scientific Fisheries. Tokyo.
- Bull. Pacific Sci. Fish. Inst.—Bulletins of the Pacific Scientific Fisheries Institute. Vladivostok.
- Bull. Pacific Sci. Inst. Fish. and Oceanogr.—Bulletin of the Pacific Scientific Institute of Fisheries and Oceanography. Vladivostok.
- Bull. Scripps Inst.—Bulletin. Scripps Institution for Biological Research. Berkeley.
- Bull. So. Calif. Acad. Sci.—Bulletin of the Southern California Academy of Sciences. Los Angeles.
- Bull. U. S. Fish Comm.—Bulletin of the United States Fish Commission. Washington.
- Bur. Fish., Min. Agr. and For., Japanese Imp. Govt.—Bureau of Fisheries. Ministry of Agriculture and Forestry. Japanese Imperial Government. [Suisankyoku. Norinshō. Dai Nippon Teikoku Seifu.] Tokyo.
- California Div. Fish and Game, Bur. Mar. Fish.—California Division of Fish and Game, Bureau of Marine Fisheries. San Francisco.
- California Div. Fish and Game, Fish Bull.—California Division of Fish and Game. Fish Bulletin. Sacramento.
- Cent. Fish. Expt. Sta. Rpt.—Central Fisheries Experiment Station Reports. [Suisan Shikenjō Chōsa Hōkoku.] Tokyo.
- Com. Fish. Rev.—Commercial Fisheries Review. Fish and Wildlife Service. United States Department of the Interior. Washington.
- Copeia—Copeia. New York.
- Council Sci. and Indust. Res., Australia, Pamphlet—Council for Scientific and Industrial Research. Commonwealth of Australia. Pamphlet. Melbourne.
- Dept. Fish., New South Wales—Department of Fisheries, New South Wales. Sydney.
- Field Mus. Nat. Hist., Zool. Ser.—Field Museum of Natural History, Zoological Series. Chicago.
- Fish. Div., FAO, UN.—Fisheries Division. The Food and Agriculture Organization of the United Nations. Washington.
- Fish. Invest. (Suppl. Rpt.), Imp. Fish. Expt. Sta.—Fishery Investigation (Supplementary Report). Imperial Fisheries Experiment Station. Tokyo.
- Fish. Res. Bd. Canada, Bull.—Fisheries Research Board of Canada, Bulletin. Vancouver.
- Fish. Technol. Lect. Series—Fisheries Technology Lecture Series. [Suisan Seizō Kōgaku Kōza.] Tokyo.
- Formosa Fish. Mag.—Formosa Fisheries Magazine. [Taiwan Suisan Zasshi.] Taihoku.
- Formosa Govt.-Gen. Fish. Expt. Sta. Publ.—Formosa Government-General Fisheries Experiment Station. Publications. [Taiwan Sotokufu Suisan Shikenjō Shuppan.] Kiirun.
- Ichth. Contrib. Internatl. Game Fish Assoc.—Ichthyological Contributions of the International Game Fish Association. New York.
- Japanese Jour. Zool.—Japanese Journal of Zoology. Tokyo.
- Jour. Acad. Nat. Sci. Phila.—Journal of the Academy of Natural Sciences of Philadelphia. Philadelphia.
- Jour. Asiatic Soc. Bengal—Journal of the Asiatic Society of Bengal. Calcutta.
- Jour. Biol. Chem.—Journal of Biological Chemistry. New York.
- Jour. Coll. Agr., Imp. Univ. Tokyo—Journal of the College of Agriculture. Imperial University of Tokyo. Tokyo.
- Jour. Coll. Sci., Imp. Univ. Tokyo—Journal of the College of Science. Imperial University of Tokyo. Tokyo.
- Jour. Council Sci. and Indust. Res., Australia—Journal of the Council for Scientific and Industrial Research. Commonwealth of Australia. Melbourne.
- Jour. Fac. Sci., Imp. Univ. Tokyo—Journal of the Faculty of Science. Imperial University of Tokyo. Tokyo.

- Jour. Imp. Fish. Bur. Tokyo—Journal of the Imperial Fisheries Bureau. Tokyo.
- Jour. Imp. Fish. Expt. Sta.—Journal of the Imperial Fisheries Experiment Station. Tokyo.
- Jour. Mus. Godeffroy—Journal des Muséum Godeffroy. Hamburg.
- Jour. Pan-Pacific Res. Inst.—Journal of the Pan-Pacific Research Institution. Honolulu.
- Mem. Bernice P. Bishop Mus.—Memoirs of the Bernice Pauahi Bishop Museum. Honolulu.
- Mem. California Acad. Sci.—Memoirs of the California Academy of Sciences. San Francisco.
- Mem. Carnegie Mus.—Memoirs of the Carnegie Museum. Pittsburgh.
- Mid-Pacific Mag.—Mid-Pacific Magazine. Honolulu.
- Miyagi Pref. Fish. Expt. Sta.—Miyagi Prefectural Fisheries Experiment Station. [Miyagi-ken Suisan Shikenjō. Watanoha.
- Nat. Geneesk. Arch. Neerland's Indië—Natuur en Geneeskundig Archief voor Neerland's-Indië. Batavia.
- Nat. Tijdschr. Nederlandsch-Indië—Natuurkundig Tijdschrift voor Nederlandsch-Indië. Batavia.
- Nederlandsch Tijdschr. Dierk.—Nederlandsch Tijdschrift voor de Dierkunde. Amsterdam.
- New Zealand Jour. Sci. Technol.—New Zealand Journal of Science and Technology. Wellington.
- New Zealand Mar. Dept. Fish. Bull.—New Zealand Marine Department Fisheries Bulletin. Wellington.
- Nissan Fish. Res. Sta. Odawara—Nissan Fisheries Research Station. [Nissan Suisan Kenkyūjō.] Odawara.
- Note Serv. Océanogr. Pêches Indochine—Notes. Service Océanographique des Pêches de l'Indochine. Station Maritime de Cauda. Saigon.
- Occas. Pap. California Acad. Sci.—Occasional Papers of the California Academy of Sciences. San Francisco.
- Ocean. Fish.—Oceanic Fisheries. [Kaiyō Gyogyō.] Tokyo.
- Pacific Biol. Sta., Fish. Res. Bd. Canada, Circ.—Pacific Biological Stations, Fisheries Research Board of Canada. Vancouver.
- Pacific Sci.—Pacific Science. Honolulu.
- Palao Trop. Biol. Sta. Studies—Palao Tropical Biological Station Studies. Tokyo.
- Philippine Jour. Sci.—Philippine Journal of Science. Manila.
- Proc. Acad. Nat. Sci. Phila.—Proceedings of the Academy of Natural Sciences of Philadelphia. Philadelphia.
- Proc. California Acad. Sci.—Proceedings of the California Academy of Sciences. San Francisco.
- Proc. Sci. Fish. Assoc.—Proceedings of the Scientific Fisheries Association. Tokyo.
- Proc. Sixth Pacific Sci. Cong.—Proceedings of the Sixth Pacific Science Congress. Berkeley and Los Angeles.
- Proc. U. S. Natl. Mus.—Proceedings of the United States National Museum. Washington.
- Proc. Zool. Acclim. Soc. Victoria—Proceedings of the Zoological and Acclimation Society of Victoria. Victoria.
- Prog. Rpt. Chiba Pref. Fish. Expt. Sta.—Progress Reports of the Chiba Prefectural Fisheries Experiment Station. [Chiba-ken Suisan Shikenjō Jigyō Hōkoku.] Tateyama.
- Prog. Rpt. Chiba Pref. Fish. Expt. Sta., Katsuura Br.—Progress Reports of the Chiba Prefectural Fisheries Experiment Station, Katsuura Branch. [Chiba-ken Suisan Shikenjō Katsuura Bunjō Jigyō Hōkoku.] Katsuura.
- Prog. Rpt. Formosa Govt.-Gen. Fish. Expt. Sta.—Progress Reports of the Formosa Government-General Fisheries Experiment Station [Taiwan Sotokufu Suisan Shikenjō; Jigyō Hōkoku; Shiken Hōkoku; Suisan Shiken Hōkoku.] Kihun.
- Prog. Rpt. Hokkaidō Fish. Expt. Sta.—Progress Reports of the Hokkaidō Fisheries Experiment Station. [Hokkaidō Suisan Shikenjō Suisan Chōsa Hōkoku.] Yoichi.
- Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta.—Progress Reports of the Kagoshima Prefectural Fisheries Experiment Station. [Kagoshima-ken Suisan Shikenjō Jigyō Hōkoku.] Kagoshima.
- Prog. Rpt. Kōchi Pref. Fish. Expt. Sta.—Progress Reports of the Kōchi Prefectural Fisheries Experiment Station. [Kōchi-ken Suisan Shikenjō Jigyō Hōkoku.] Susaki.
- Prog. Rpt. Kumamoto Pref. Fish. Expt. Sta.—Progress Reports of the Kumamoto Prefectural Fisheries Experiment Station. [Kumamoto-ken Suisan Shikenjō Jigyō Hōkoku.] Kumamoto.
- Prog. Rpt. Mie Pref. Fish. Expt. Sta.—Progress Reports of the Mie Prefectural Fisheries Experiment Station. [Mie-ken Suisan Shikenjō Jigyō Hōkoku.] Tsu.
- Prog. Rpt. Nagasaki Pref. Fish. Expt. Sta.—Progress Reports of the Nagasaki Prefectural Fisheries Experiment Station. [Nagasaki-ken Suisan Shikenjō Jigyō Hōkoku.] Nagasaki.
- Prog. Rpt. Ōita Pref. Fish. Expt. Sta.—Progress Reports of the Ōita Prefectural Fisheries Experiment Station. [Ōita-ken Suisan Shikenjō Gyōmu Hōkoku.] Ōita.
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Kishinouye, 1919c, 1923.

Roedel, 1948a.

Schaefer, 1948c.

Schaefer and Marr, 1948b.

Euthynnus lineatus—Continued

Description—Continued

Schmitt and Schultz, 1940.

Seale, 1940.

Walford, 1937.

Figured

Fowler, 1944.

Fraser-Brunner, 1949.

Kishinouye, 1923.

Schaefer and Marr, 1948b.

Walford, 1937.

Food

Kishinouye, 1923.

Walford, 1937.

Habits

Kishinouye, 1923.

Keys

Fraser-Brunner, 1949.

Kishinouye, 1923.

Walford, 1937.

Meristic characters

Schaefer and Marr, 1948b.

Reproduction

Schaefer, 1948c.

Walford, 1937.

Synonymy

Fowler, 1938, 1944.

Fraser-Brunner, 1949.

Kishinouye, 1923.

Young

Schaefer, 1948c.

Schaefer and Marr, 1948b.

Euthynnus macroptera

Distribution

Tubb, 1948.

Euthynnus pelamis. See *Katsuwonus pelamis*.*Euthynnus pelamys*. See *Katsuwonus pelamis*.*Euthynnus vagans*. See *Katsuwonus pelamis*.*Euthynnus wallisi*

Distribution

Fowler, 1949.

Synonymy

Fowler, 1949.

Euthynnus yaito

Anatomy

Kishinouye, 1915a, 1915b, 1919a, 1923.

Chemical analysis

Miyachi, 1915.

Classification

Fraser-Brunner, 1949.

Kishinouye, 1915a, 1923.

Nakamura, 1939b.

Okada and Matsubara, 1938.

Common names

Chevey, 1932a.

Fujita and Wakiya, 1915.

Herre and Umali, 1948.

Kishinouye, 1915a, 1923.

Nakamura, 1939b.

Okada and Matsubara, 1938.

Euthynnus yaito—Continued

Common names—Continued

Shapiro, 1948b.
Tominaga, 1943.

Compared with *Wanderer wallisi*

Whitley, 1937.

Description

Chevey, 1932a.
Kishinouye, 1915a, 1923.
Okada and Matsubara, 1938.
Tominaga, 1943.

Distribution

Chevey, 1932a, 1932b.
Domantay, 1940.
Eckles, 1949a.
Fraser-Brunner, 1949.
Fujita and Wakiya, 1915.
Godsil and Greenwood, 1948.
Herre, 1933, 1940.
Jordan and Evermann, 1926a.
Jordan and Hubbs, 1925.
Kishinouye, 1915a, 1922c, 1923.
Okada and Matsubara, 1938.
Schaefer, 1948c.
Shapiro, 1948b.
Smith and Schaefer, 1949.
Tominaga, 1943.

Figured

Chevey, 1932a.
Domantay, 1940.
Fraser-Brunner, 1949.
Kishinouye, 1915a, 1923.
Smith and Schaefer, 1949.

Food

Herald, 1949.
Kishinouye, 1923.
Tominaga, 1943.
Welsh, 1949.

Habits

Kishinouye, 1923.
Tominaga, 1943.

Keys

Brock, 1949.
Fraser-Brunner, 1949.
Kishinouye, 1915a, 1923.
Okada and Matsubara, 1938.

Measurement data

Bonham, 1946.

Parasites

Kishinouye, 1923.

Reproduction

Kishinouye, 1923.
Schaefer, 1948c.

Synonymy

Chevey, 1932a, 1934.
Fraser-Brunner, 1949.
Jordan and Hubbs, 1925.
Kishinouye, 1923.
Nakamura, 1939b.

Euthynnus yaito—Continued

Young

Kishinouye, 1919b, 1923, 1924.
Schaefer, 1948c.

Euthynnus alletteratus. See *Euthynnus alletteratus*.

Evolution

Based on internal anatomy
Kishinouye, 1919a.

Exploitation rates

Tauchi, 1940a, 1940b, 1940c.

Fishing conditions

Correlated with area

Hart and Hollister, 1947.
Hart et al., 1948.

Correlated with astronomical phenomena. See Astronomical phenomena.

Correlated with oceanography. See Oceanographic conditions.

Correlated with season

Hart et al., 1948.
Inanami, 1942b.
Whitehead, 1929.

Fishing grounds

Location correlated with oceanography. See Oceanographic conditions.

Food

Anonymous, 1938.
Asano, 1939.
Ban, 1941.
Bennett, 1840.
Chapman, 1946.
Clemens and Wilby, 1946.
Delsman and Hardenburg, 1934.
Eckles, 1949b.
Fitch, 1950.
Formosa Govt.-Gen. Fish. Expt. Sta., 1933a.
Hart and Hollister, 1947.
Hart et al., 1948.
Hatai et al., 1941.
Herald, 1949.
Hildebrand, 1946.
Imamura, 1949.
Japanese Bur. Fish., 1934, 1939, 1940.
Jordan and Gilbert, 1881b, 1882.
Kanamura and Yazaki, 1940a, 1940b.
Kishinouye, 1895, 1915a, 1917b, 1923.
Kuronuma, 1940.
Marukawa, 1939.
Miyama, Saruya, and Hasegawa, 1939.
Nakamura, 1936, 1943, 1949.
Nakamura Res. Staff, 1949.
Okuma, Imaizumi, and Maki, 1935.
Scigel, 1949.
Serventy, 1942a.
Shapiro, 1948a.
Starks, 1918.
Starks and Morris, 1907.
Suyehiro, 1936, 1938, 1942.
Taihoku Prov. Fish. Expt. Sta., 1928, 1929.

Food—Continued

- Tinker, 1944.
 Tominaga, 1943.
 Walford, 1937.
 Watanabe, H., 1939.
 Welsh, 1949.
 Whitley, 1937.
 Yabe and Mori, 1948.

- Germo alabunga*. See *Thunnus germo*.
Germo alatunga. See *Thunnus germo*.
Germo albacores. See *Neothunnus itosibi*.
Germo argentivittatus. See *Neothunnus argentivittatus*.
Germo germo. See *Thunnus germo*.
Germo germon. See *Thunnus germo*.
Germo macropterus. See *Neothunnus macropterus*.
Germo sibi. See *Parathunnus sibi*.
 Gravity, specific. See Specific gravity, also Oceanographic conditions.

Growth

- Aikawa and Kato, 1938.
 Brock, 1943.
 Kimura, 1932, 1935.
 Kishinouye, 1923.
 Schaefer, 1948a, 1948b.
Gymnosarda affinis. See *Katsuwonus pelamis*.
Gymnosarda alletterata. See *Euthynnus alletteratus*.
Gymnosarda pelamis. See *Katsuwonus pelamis*.

Habits

- Brock, 1949.
 Imamura, 1949.
 Jordan and Gilbert, 1882.
 Kida, 1936.
 Kishinouye, 1915a, 1923.
 Nakamura, 1949.
 Roughly, 1916.
 Schaefer, 1948b.
 Serventy, 1942a.
 Shapiro, 1948a.
 Tinker, 1944.
 Tominaga, 1943.
 Uchida, 1923.
 Uda, 1935b, 1940a.
 Uda and Tsukushi, 1934.

Hermaphroditism

- Nakamura, 1935.

Hormones

- Migita and Arakawa, 1948.
 Oya and Takahashi, 1936.
 Toyama et al., 1941.

Juveniles. See Young.

Katsuwonidae

Anatomy

- Kishinouye, 1917a, 1919a.

Classification

- Kishinouye, 1917a.

Compared with *Allothunnus fallai*

- Serventy, 1948.

Katsuwonidae—Continued

Keys

- Jordan and Hubbs, 1925.

Katsuwonus pelamis

Age

- Aikawa, 1937.
 Aikawa and Kato, 1938.
 Higashi, 1941b.
 Kimura, 1941.
 Okamoto, 1940.
 Yabe and Mori, 1948.

Anatomy

- Eckles, 1949b.
 Godsil and Byers, 1944.
 Higashi, 1941a.
 Imamura, 1949.
 Kishinouye, 1915a, 1915b, 1918, 1919a, 1923.
 Matsui, 1942a, 1942b.
 Suyehiro, 1936, 1938, 1941, 1942.

Body condition

- Aikawa, 1937.
 Aikawa and Kato, 1938.
 Ikebe and Matsumoto, 1937.
 Onodera, 1941.
 South Seas Govt.-Gen. Fish. Expt. Sta., 1941d.
 Suyehiro, 1936, 1938.

Body temperature

- Uda, 1941.
 Watanabe, N., 1941.

Catch per unit of effort

- Kanamura and Yazaki, 1940a, 1940b.

Chemical analysis

- Higashi and Hirai, 1948.
 Kodama, Iizuka, and Harada, 1934.
 Miyama and Osakabe, 1938, 1940.
 Miyauchi, 1915.
 Okuda, 1918.

Classification

- Fraser-Brunner, 1950.
 Godsil and Byers, 1944.
 Hildebrand, 1946.
 Kishinouye, 1915a, 1923.
 Nakamura, 1939b.
 Okada and Matsubara, 1938.
 Phillipps, 1927b.
 Roedel, 1948b.
 Shapiro, 1948a.
 Soldatov and Lindberg, 1930.
 Taranetz, 1937.
 Walford, 1931.

Common names

- Barnhart, 1936.
 Craig, 1929.
 Delsman and Hardenburg, 1934.
 FAO, 1949.
 Fish, 1948.
 Fujita and Wakiya, 1915.
 Herre and Umali, 1948.
 Jordan and Evermann, 1896, 1905.
 Jordan and Hubbs, 1925.

Katsuwonus pelamis—Continued

Common names—Continued

- Jordan and Jordan, 1922.
 Jordan and Snyder, 1901.
 Jordan, Tanaka, and Snyder, 1913.
 Kishinouye, 1915a, 1923.
 Kumata et al., 1941.
 Nakamura, 1939b.
 Okada and Matsubara, 1938.
 Phillipps, 1927b.
 Roedel, 1948b.
 Serventy, 1941.
 Shapiro, 1948a, 1948b.
 Smith, 1947.
 Starks and Morris, 1907.
 Tanaka, 1912.
 Tinker, 1944.
 Tominaga, 1943.
 Ulrey and Greeley, 1928.
 Walford, 1931, 1937.
 Whitley, 1947.

Compared with *Thynnus affinis*

- Cantor, 1850.

Description

- Barnhart, 1936.
 Bennett, 1840.
 Bleeker, 1856.
 Boeseman, 1947.
 Clemens and Wilby, 1946.
 Cuvier and Valenciennes, 1934.
 Delsman and Hardenburg, 1934.
 Eigenmann and Eigenmann, 1890.
 Fowler, 1928, 1938.
 Fraser-Brunner, 1950.
 Godsil and Byers, 1944.
 Günther, 1860, 1876.
 Hildebrand, 1946.
 Imamura, 1949.
 Jordan and Evermann, 1905.
 Kishinouye, 1915a, 1922b, 1923.
 Lesson, 1830.
 Macleay, 1881.
 Meek and Hildebrand, 1923.
 Nakamura, 1939b.
 Okada and Matsubara, 1938.
 Roedel, 1948b.
 Seale, 1940.
 Serventy, 1941.
 Shapiro, 1948a.
 Soldatov and Lindberg, 1930.
 Stead, 1906.
 Tanaka, 1912.
 Temminck and Schlegel, 1850.
 Tinker, 1944.
 Tominaga, 1943.
 Walford, 1931, 1937.

Distribution

- Abe, 1939.
 Anonymous, 1941.
 Barnhart, 1936.

Katsuwonus pelamis—Continued

Distribution—Continued

- Bleeker, 1856, 1860a, 1862, 1865a.
 Chapman, 1946.
 Clemens and Wilby, 1946.
 Cuvier and Valenciennes, 1831.
 Delsman and Hardenburg, 1934.
 Domantay, 1940.
 Eckles, 1949a.
 Eigenmann, 1892.
 Eigenmann and Eigenmann, 1890, 1891.
 Evermann and Seale, 1907.
 FAO, 1949.
 Fish, 1948.
 Fowler, 1928, 1931, 1934, 1938, 1944, 1949.
 Fraser-Brunner, 1950.
 Fujita and Wakiya, 1915.
 Godsil and Greenhood, 1948.
 Günther, 1860, 1876.
 Herre, 1932, 1933, 1935, 1936, 1940.
 Hildebrand, 1946.
 Imamura, 1949.
 Jenkins, 1903.
 Jordan and Evermann, 1896, 1905.
 Jordan and Hubbs, 1925.
 Jordan and Jordan, 1922.
 Jordan and Seale, 1906.
 Jordan and Snyder, 1901.
 Jordan and Starks, 1907.
 Jordan, Tanaka, and Snyder, 1913.
 Kanamura and Yazaki, 1940a, 1940b.
 Kimura, 1941, 1942b.
 Kishinouye, 1915a, 1923.
 Kumata et al., 1941.
 Lesson, 1830.
 Macleay, 1881.
 Martin, 1938.
 Matsubara, 1943.
 McCulloch, 1922.
 Meek and Hildebrand, 1923.
 Nakamura, 1939b.
 Nichols and Murphy, 1944.
 Okada and Matsubara, 1938.
 Okinawa Pref. Fish. Expt. Sta., 1943.
 Phillipps, 1927a, 1927b.
 Phillipps and Hodgkinson, 1922.
 Reeves, 1928.
 Richardson, 1846.
 Roedel, 1948b.
 Roughly, 1916.
 Schaefer, 1948c.
 Seale, 1940.
 Serventy, 1941, 1947.
 Shapiro, 1948a, 1948b.
 Smith and Schaefer, 1949.
 Soldatov and Lindberg, 1930.
 South Seas Govt.—Gen. Fish. Expt. Sta., 1937a.
 Starks and Morris, 1907.
 Stead, 1906, 1908.
 Tanaka, 1912, 1931.

Katsuwonus pelamis—Continued

Distribution—Continued

Taranetz, 1937.
 Tinker, 1944.
 Tominaga, 1943.
 Ulrey, 1929.
 Ulrey and Greeley, 1928.
 Waite, 1907.
 Walford, 1931, 1937.
 Whitehead, 1929.
 Whitley, 1947.

Distribution correlated with water temperature

Takayama, Ikeda, and Ando, 1934.
 Uda, 1935b, 1936, 1940b.

Eggs

Hatai et al., 1941.
 Murr, 1948.
 Nakamura Res. Staff, 1949.
 Yabe and Mori, 1948.

Enemies

Imamura, 1949.
 Tinker, 1944.

Figured

Barnhart, 1936.
 Clemens and Wilby, 1946.
 Cuvier and Valenciennes, 1831.
 Domantay, 1940.
 Eckles, 1949a.
 Fraser-Brunner, 1950.
 Godsil and Byers, 1944.
 Jordan and Evermann, 1905.
 Kishinouye, 1915a, 1923.
 Kitahara, 1897.
 Kumata et al., 1941.
 Lesson, 1830.
 McCulloch, 1922.
 Nakamura, 1939b.
 Roedel, 1948b.
 Serventy, 1941.
 Shapiro, 1948a.
 Smith and Schaefer, 1949.
 Tanaka, 1912.
 Temminck and Schlegel, 1850.
 Tinker, 1944.
 Walford, 1931, 1937.

Fishing conditions correlated with oceanography

Aikawa, 1933.
 Chiba Pref. Fish. Expt. Sta., Katsuura Br., 1936, 1937,
 1938, 1941.
 Formosa Govt.-Gen. Fish. Expt. Sta., 1930, 1931, 1932,
 1933b, 1934.
 Imamura, 1949.
 Inanami, 1941, 1942d.
 Kagoshima Pref. Fish. Expt. Sta., 1925, 1926a, 1926b,
 1927b, 1928a, 1929a, 1930a, 1931a, 1932a, 1933a, 1935,
 1936a, 1937.
 Kanamura and Yazaki, 1940b.
 Kawamura, 1939.
 Kimura, 1941, 1940.
 Kōchi Pref. Fish. Expt. Sta., 1923a.

Katsuwonus pelamis—Continued

Fishing conditions correlated with oceanography—Con.

Kumamoto Pref. Fish. Expt. Sta., 1946.
 Mie Pref. Fish. Expt. Sta., 1930a, 1930b, 1930d.
 Okinawa Pref. Fish. Expt. Sta., 1940a, 1943.
 Sasaki, 1939a.
 Shapiro, 1948a.
 Shimamura, 1927.
 Shizuoka Pref. Fish. Expt. Sta., 1936, 1937.
 South Seas Govt.-Gen. Fish. Expt. Sta., 1937c, 1938,
 1942, 1943b.
 Taihoku Prov. Fish. Expt. Sta., 1927a, 1927b, 1929,
 1932.
 Takayama, Ikeda, and Ando, 1934.
 Uda, 1935b, 1938, 1939, 1940c.
 Uehara, 1941.
 Yabe and Mori, 1948.

Fishing conditions correlated with weather

Kanamura and Yazaki, 1940b.
 Okinawa Pref. Fish. Expt. Sta., 1940a, 1943.
 Taihoku Prov. Fish. Expt. Sta., 1927a, 1927b.
 Uda and Watanabe, 1938.

Food

Clemens and Wilby, 1946.
 Delsman and Hardenburg, 1934.
 Eckles, 1949b.
 Hatai et al., 1941.
 Hildebrand, 1946.
 Imamura, 1949.
 Kishinouye, 1917b, 1923.
 Nakamura Res. Staff, 1949.
 Shapiro, 1948a.
 Suyehiro, 1936, 1938, 1942.
 Taihoku Prov. Fish. Expt. Sta., 1928, 1929.
 Tinker, 1944.
 Tominaga, 1943.
 Walford, 1937.
 Yabe and Mori, 1948.

Growth

Aikawa and Kato, 1938.

Habits

Imamura, 1949.
 Kishinouye, 1923.
 Shapiro, 1948a.
 Tinker, 1944.
 Tominaga, 1943.
 Uchida, 1923.
 Uda, 1935b, 1940a.
 Uda and Tsukushi, 1934.

Hermaphroditism

Nakamura, 1935.

Hormones

Migita and Arakawa, 1948.
 Oya and Takahashi, 1936.
 Toyama et al., 1941.

Keys

Brock, 1949.
 Delsman and Hardenburg, 1934.
 Fraser-Brunner, 1950.
 Godsil and Byers, 1944.

Katsuwonus pelamis—Continued

Keys—Continued

- Hildebrand, 1946.
 Kishinouye, 1915a, 1923.
 McCulloch, 1922.
 Meek and Hildebrand, 1923.
 Okada and Matsubara, 1938.
 Roedel, 1948b.
 Serventy, 1941.
 Soldatov and Lindberg, 1930.
 Taranetz, 1937.
 Walford, 1931, 1937.

Length-weight relation

- Bonham, 1946.

Measurement data

- Aikawa and Kato, 1938.
 Bonham, 1946.
 Godsil and Byers, 1944.
 Higashi, 1940a; 1940b, 1941a, 1941b, 1942.
 Ikebe and Matsumoto, 1937.
 Kagoshima Pref. Fish. Expt. Sta., 1925, 1926a, 1927b,
 1928a, 1929a, 1936a, 1937, 1938a, 1939a, 1940a, 1941.
 Kodama, Iizuka, and Harada, 1934.
 Marr, 1948.
 Nakamura Res. Staff, 1949.
 Ōita Pref. Fish. Expt. Sta., 1925.
 Okinawa Pref. Fish. Expt. Sta., 1931.
 Onodera, 1941.
 Schaefer, 1948b.
 South Seas Govt.-Gen. Fish. Expt. Sta., 1941d.
 Suyehiro, 1936, 1938.
 Taihoku Prov. Fish. Expt. Sta., 1928, 1929.
 Uda, 1941.
 Watanabe, N., 1941.
 Yabe and Mori, 1948.
 Yamamoto, 1940.

Meristic characters

- Godsil and Byers, 1944.
 Nakamura Res. Staff, 1949.

Migration

- Hatai et al., 1941.
 Imamura, 1949.
 Kimura, 1941, 1942b.
 Kishinouye, 1923.
 Matsubara, 1943.
 Matsumoto, 1937.
 Sasaki, 1939a.
 Shapiro, 1948a, 1948b.
 Tominaga, 1943.
 Uda, 1936.
 Walford, 1937.

Parasites

- Bennett, 1940.
 Harada, 1928.
 Kishinouye, 1923.
 Manter, 1940.
 Van Cleave, 1940.

Populations

- Aikawa, 1937.
 Godsil and Byers, 1944.

Katsuwonus pelamis—Continued

Populations—Continued

- Imamura, 1949.
 Tauchi, 1941.
 Tominaga, 1943.
 Uda and Tsukushi, 1934.

Reproduction

- Eckles, 1949b.
 Hatai et al., 1941.
 Imamura, 1949.
 Kishinouye, 1923.
 Marr, 1948.
 Schaefer, 1948c.
 Schaefer and Marr, 1948a.
 Shapiro, 1948b.
 Walford, 1937.
 Yabe and Mori, 1948.

Sex ratio

- Ikebe and Matsumoto, 1937.
 Marr, 1948.
 Nakamura Res. Staff, 1949.

Sexual dimorphism

- Hatai et al., 1941.

Sexual maturity

- Hatai et al., 1941.
 Marr, 1948.
 Matsubara, 1943.
 Matsui, 1942b.
 Nakamura Res. Staff, 1949.
 Okinawa Pref. Fish. Expt. Sta., 1931.
 Schaefer and Marr, 1948a.
 Yabe and Mori, 1948.

Size composition

- Aikawa, 1937.
 Aikawa and Kato, 1938.
 Inanami, 1942b.
 Kagoshima Pref. Fish. Expt. Sta., 1937.
 Kimura, 1941.
 Nakamura Res. Staff, 1949.
 Okamoto, 1940.
 Sasaki, 1939a.
 Uda, 1935b.
 Uda and Tsukushi, 1934.
 Yabe and Mori, 1948.

Swimming velocity

- Watanabe, N., 1941.

Synonymy

- Bleeker, 1856.
 Boeseman, 1947.
 Evermann and Seale, 1907.
 FAO, 1949.
 Fish, 1948.
 Fowler, 1928, 1934, 1944, 1949.
 Fraser-Brunner, 1950.
 Günther, 1860, 1876.
 Herre, 1936.
 Hildebrand, 1946.
 Jenkins, 1903.
 Jordan and Evermann, 1896, 1905.
 Jordan, Tanaka, and Snyder, 1913.

Katsuwonus pelamis—Continued

Synonymy—Continued

Kishinouye, 1923.
McCulloch, 1922.
Meek and Hildebrand, 1923.
Nakamura, 1939b.
Phillipps, 1927b.
Richardson, 1846.
Soldatov and Lindberg, 1930.
Tanaka, 1912, 1931.
Ulrey and Greeley, 1928.
Waite, 1907.

Tagging

Anonymous, 1939.
Fukuda and Iizuka, 1940b.
Godsil, 1938.
Kagoshima Pref. Fish. Expt. Sta., 1928a, 1936b, 1938b,
1939b, 1940b.
Matsumoto, 1937.
South Seas Govt.-Gen. Fish. Expt. Sta., 1941c.
Uda, 1936.

Young

Eckles, 1949b.
Hatal et al., 1941.
Inanami, 1942c.
Kishinouye, 1919b, 1923, 1924, 1926.
Marr, 1948.
Schaefer, 1948c.
Schaefer and Marr, 1948a.
Yabe and Mori, 1948.

Young as food of tuna

Kishinouye, 1917b.
Marukawa, 1939.

Katsuwonus pelumys. See *Katsuwonus pelamis*.

Katsuwonus vagans. See *Katsuwonus pelamis*.

Katwonus vagans. See *Katsuwonus pelamis*.

Keys

Brock, 1949.
Delsman and Hardenburg, 1934.
Fraser-Brunner, 1940, 1950.
Godsil and Byers, 1944.
Hildebrand, 1946.
Jordan and Evermann, 1926b.
Jordan and Hubbs, 1925.
Kishinouye, 1915a, 1923.
McCulloch, 1922.
Meek and Hildebrand, 1923.
Nakamura, 1949.
Okada and Matsubara, 1938.
Roedel, 1948b.
Serventy, 1941.
Soldatov and Lindberg, 1930.
Taranetz, 1937.
Wade, 1949.
Walford, 1931, 1937.

Kishinoella

Keys

Soldatov and Lindberg, 1930.

Kishinoella rara

Classification

Nakamura, 1939b.
Okada and Matsubara, 1938.

Common names

Jordan and Evermann, 1926b.
Jordan and Hubbs, 1925.
Nakamura, 1939b.
Okada and Matsubara, 1938.

Compared with *Kishinoella zacalles*

Nakamura, 1939b.

Description

Jordan and Evermann, 1926b.
Jordan and Hubbs, 1925.
Nakamura, 1939b.
Okada and Matsubara, 1938.

Distribution

Jordan and Evermann, 1926a, 1926b.
Jordan and Hubbs, 1925.
Nakamura, 1939b.
Okada and Matsubara, 1938.

Figured

Nakamura, 1939b.

Keys

Brock, 1949.
Jordan and Evermann, 1926b.
Okada and Matsubara, 1938.

Synonymy

Nakamura, 1939b.

Kishinoella tonggol

Anatomy

Serventy, 1942b.

Common names

Serventy, 1941.
Whitley, 1947.

Compared with *Kishinoella zacalles*

Serventy, 1942b.

Compared with *Neothunnus rarus*

Serventy, 1942b.

Compared with *Thunnus maccoyi*

Serventy, 1941.

Compared with *Thunnus nicolsoni*

Serventy, 1942b.

Compared with *Thunnus tonggol*

Serventy, 1942b.

Description

Serventy, 1941, 1942b.

Distribution

Serventy, 1941, 1942a, 1942b.
Whitley, 1947.

Figured

Serventy, 1941, 1942b.

Food

Serventy, 1942a.

Habits

Serventy, 1942a.

Keys

Serventy, 1941.

Length-weight relation

Serventy, 1941.

Kishinoella tonggol—Continued

Measurement data

Serventy, 1942b.

Reproduction

Serventy, 1942a.

Synonymy

Serventy, 1942b.

Kishinoella zacalles

Classification

Fraser-Brunner, 1950.

Nichols and LaMonte, 1941.

Compared with *Kishinoella rara*

Nakamura, 1939b.

Compared with *Kishinoella tonggol*

Serventy, 1942b.

Description

Fraser-Brunner, 1950.

Jordan and Evermann, 1926b.

Distribution

Fraser-Brunner, 1950.

Jordan and Evermann, 1926b.

Figured

Fraser-Brunner, 1950.

Jordan and Evermann, 1926b.

Keys

Fraser-Brunner, 1950.

Jordan and Evermann, 1926b.

Synonymy

Fraser-Brunner, 1950.

Length-weight data. See Morphometrics.

Mackerel, frigate. See *Auzis* spp.

Management

Schaefer, 1948c.

Maturity

Anonymous, 1938.

Ban, 1941.

Clark, 1929.

Hatai et al., 1941.

Ikebe, 1939.

Imaizumi, 1937.

Kanamura and Imaizumi, 1935.

Kanamura and Yazaki, 1940a, 1940b.

Kato, 1940.

Marr, 1948.

Matsubara, 1943.

Matsui, 1942b.

Nakamura, 1938.

Nakamura Res. Staff, 1949.

Okinawa Pref. Fish. Expt. Sta., 1931.

Okuma, Imaizumi, and Maki, 1935.

Schaefer, 1948b.

Schaefer and Marr, 1948a.

Soc. Prom. Ocean. Fish., 1936.

Watanabe, H., 1939.

Measurement data. See Morphometrics.

Migration.

Cobb, 1919.

Hatai et al., 1941.

Migration—Continued

Imamura, 1949.

Kimura, 1941, 1942b.

Kishinouye, 1923.

Kōchi Pref. Fish. Expt. Sta., 1923b, 1924.

Matsubara, 1943.

Matsumoto, 1937.

Nakamura, 1943, 1949.

Sasaki, 1939a, 1939b.

Serventy, 1941.

Shapiro, 1948a, 1948b.

Soc. Prom. Ocean. Fish., 1936.

Tauchi, 1940b.

Tominaga, 1943.

Uda, 1936.

Walford, 1937.

Whitehead, 1931.

Morphometrics

Length-weight relation

Bonham, 1946.

Hiratsuka and Morita, 1935.

Schaefer, 1948a.

Serventy, 1941.

Measurement data

Aikawa and Kato, 1938.

Anonymous, 1938.

Bonham, 1946.

Brock, 1943, 1949.

Formosa Govt.-Gen. Fish. Expt. Sta., 1933a.

Godsil, 1948.

Godsil and Byers, 1944.

Higashi, 1940a, 1940b, 1941a, 1941c, 1942.

Hiratsuka and Imaizumi, 1934.

Hiratsuka and Ito, 1934.

Ikebe, 1939, 1940a, 1940b, 1940c, 1941a, 1941b.

Ikebe and Matsumoto, 1937.

Inanami, 1940a.

Japanese Bur. Fish., 1939, 1940.

Kagoshima Pref. Fish. Expt. Sta., 1925, 1926a, 1927b,

1928a, 1929a, 1936a, 1937, 1938a, 1939a, 1940a, 1941.

Kanamura and Imaizumi, 1935.

Kanamura and Yazaki, 1940a, 1940b.

Kodama, Izuka, and Harada, 1934.

Marr, 1948.

Miyama, Saruya, and Hasegawa, 1939.

Nakamura, 1936, 1939a, 1939b.

Nakamura Res. Staff, 1949.

Ōita Pref. Fish. Expt. Sta., 1925, 1927a, 1927b, 1930.

Okinawa Pref. Fish. Expt. Sta., 1931.

Okuma, Imaizumi, and Maki, 1935.

Onodera, 1941.

Schaefer, 1948a, 1948b.

Serventy, 1942b, 1948.

South Seas Govt.-Gen. Fish. Expt. Sta., 1941d, 1943a.

Suyehiro, 1936, 1938.

Taihoku Prov. Fish. Expt. Sta., 1928, 1929.

Uda, 1932, 1941.

Uno, 1936b.

Wade, 1949.

Watanabe, Hajime, 1939.

Morphometrics—Continued

Measurement data—Continued

- Watanabe, Haruo, 1940.
Watanabe, N., 1941.
Yabe and Mori, 1948.
Yamamoto, 1940.

Meristic characters

- Clark, 1929.
Godsil and Byers, 1944.
Nakamura Res. Staff, 1949.
Schaefer and Marr, 1948b.
Wade, 1949.

Methods of measurement

- Godsil, 1948.
Godsil and Byers, 1944.
Marr and Schaefer, 1949.

Sex ratio

- Brock, 1943.
Ikebe and Matsumoto, 1937.
Marr, 1948.
Miyama, Saruya, and Hasegawa, 1939.
Nakamura Res. Staff, 1949.

*Neothunnus*Compared with *Semathunnus*

- Fowler, 1933.
Nakamura, 1939a.

New species recorded

- Jordan and Evermann, 1926a.

Neothunnus albacora

Classification

- Nichols and LaMonte, 1941.

Common names

- Nichols and LaMonte, 1941.

Description

- Nichols and LaMonte, 1941.

Keys

- Nichols and LaMonte, 1941.

Synonymy

- Nichols and LaMonte, 1941.

Neothunnus albacora albacora. See *Neothunnus albacora*.

Neothunnus albacora macropterus. See *Neothunnus macropterus*.

Neothunnus allisoni

Classification

- Nichols and LaMonte, 1941.

Common names

- Nichols and LaMonte, 1941.

Compared with *Neothunnus macropterus*

- Walford, 1937.

Description

- Nichols and LaMonte, 1941.

Keys

- Nichols and LaMonte, 1941.

Synonymy

- Nichols and LaMonte, 1941.

Neothunnus allisoni allisoni. See *Neothunnus allisoni*.

Neothunnus allisoni itosibi. See *Neothunnus itosibi*.

Neothunnus argentevittatus

Common names

- Nichols and Murphy, 1922.

Description

- Nichols and Murphy, 1922.

Distribution

- Fowler, 1944.
Jordan and Jordan, 1922.
Nichols and Murphy, 1922.

Neothunnus catalinae

Classification

- Nichols and LaMonte, 1941.

Common names

- Craig, 1929.
Nichols and LaMonte, 1941.

Description

- Jordan and Evermann, 1926b.
Nichols and LaMonte, 1941.

Distribution

- Jordan and Evermann, 1926b.
Ulrey, 1929.

Figured

- Jordan and Evermann, 1926b.

Keys

- Jordan and Evermann, 1926b.
Nichols and LaMonte, 1941.

Synonymy

- Nichols and LaMonte, 1941.

Neothunnus itosibi

Classification

- Nichols and LaMonte, 1941.
Okada and Matsubara, 1938.

Common names

- Jordan and Evermann, 1926b.
Okada and Matsubara, 1938.

Compared with *Neothunnus macropterus*

- Nakamura, 1939a, 1939b.

Description

- Fowler, 1928.
Jordan and Evermann, 1926b.
Okada and Matsubara, 1938.
Powell, 1937.

Distribution

- Domantay, 1940.
Fowler, 1928.
Jordan and Evermann, 1926b.
Martin, 1938.
Okada and Matsubara, 1938.
Powell, 1937.

Figured

- Domantay, 1940.
Jordan and Evermann, 1926b.
Powell, 1937.

Keys

- Jordan and Evermann, 1926b.
Okada and Matsubara, 1938.

Synonymy

- Fowler, 1928.
Powell, 1937.

Neothunnus macropterus

Age

- Aikawa and Kato, 1938.
 Ban, 1941.
 Higashi, 1941b.
 Ikebe, 1939, 1940a, 1940b, 1940c, 1941a, 1941b.
 Kanamura and Yazaki, 1940a, 1940b.
 Kimura, 1942a.
 Schaefer, 1948b.
 Tauchi, 1940b.

Anatomy

- Fish, 1948.
 Godsil and Byers, 1944.
 Higashi, 1941c.
 Kishinouye, 1915a, 1915b, 1919a, 1922a, 1923.
 Matsui, 1942a.
 Migita and Arakawa, 1948.
 Nakamura, 1949.
 Suyehiro, 1941, 1942.

Body condition

- Aikawa and Kato, 1938.
 Ikebe, 1939.
 Kanamura and Yazaki, 1940a, 1940b.

Body temperature

- Anonymus, 1938.
 Kanamura and Imaizumi, 1935.
 Kanamura and Yazaki, 1940a, 1940b.
 Nakamura, 1941.
 Ōita Pref. Fish. Expt. Sta., 1927a, 1930.

Catch per unit of effort

- Formosa Govt.-Gen. Fish Expt. Sta., 1933a.
 Hiratsuka and Imaizumi, 1934.
 Hiratsuka and Ito, 1934.
 Imaizumi, 1937.
 Kanamura and Imaizumi, 1935.
 Kanamura and Yazaki, 1940a, 1940b.
 Nakamura, 1949.
 Okuma, Imaizumi, and Maki, 1935.

Chemical analysis

- Dill, 1921.
 Higashi and Hirai, 1948.
 Miyama and Osakabe, 1940.
 Miyama, Saruya, and Hasegawa, 1939.

Classification

- Fraser-Brunner, 1950.
 Godsil and Byers, 1944.
 Hildebrand, 1946.
 Kishinouye, 1915a, 1923.
 Nakamura, 1939a, 1939b, 1943, 1949.
 Nichols and LaMonte, 1941.
 Okada and Matsubara, 1938.
 Roedel, 1948b.
 Schaefer, 1948a.
 Shapiro, 1948a.
 Soldatov and Lindberg, 1930.
 Taranetz, 1937.
 Walford, 1931.

Common names

- Barnhart, 1936.
 Delsman and Hardenburg, 1934.

Neothunnus macropterus—Continued

Common names—Continued

- FAO, 1949.
 Fish, 1948.
 Fujita and Wakiya, 1915.
 Herre and Umali, 1948.
 Jordan and Evermann, 1926b.
 Jordan and Hubbs, 1925.
 Jordan and Jordan, 1922.
 Jordan and Snyder, 1901.
 Jordan, Tanaka, and Snyder, 1913.
 Kishinouye, 1915a, 1923.
 Kumata et al., 1941.
 Nakamura, 1939b, 1943, 1949.
 Okada and Matsubara, 1938.
 Roedel, 1948b.
 Serventy, 1941.
 Shapiro, 1948a, 1948b.
 Smith, 1947.
 Starks and Morris, 1907.
 Tinker, 1944.
 Ulrey and Greeley, 1928.
 Walford, 1931, 1937.
 Whitley, 1947.

Compared with *Neothunnus allisoni*
 Walford, 1937.

Compared with *Neothunnus itosibi*
 Nakamura, 1939a, 1939b.

Compared with *Parathunnus mebachi*
 Roedel, 1948b.

Compared with *Semathunnus guildi*
 Nakamura, 1939b.

Compared with *Thunnus thynnus*
 Thompson and Higgins, 1919.

Description

- Barnhart, 1936.
 Boeseman, 1947.
 Delsman and Hardenburg, 1934.
 Fowler, 1928.
 Fraser-Brunner, 1950.
 Godsil and Byers, 1944.
 Hildebrand, 1946.
 Jordan and Evermann, 1926b.
 Jordan and Hubbs, 1925.
 Jordan and Jordan, 1922.
 Jordan and Starks, 1907.
 Kishinouye, 1915a, 1923.
 Matsubara, 1943.
 Nakamura, 1939b, 1949.
 Okada and Matsubara, 1938.
 Roedel, 1948b.
 Seale, 1940.
 Serventy, 1941.
 Shapiro, 1948a.
 Soldatov and Lindberg, 1930.
 Starks, 1918.
 Temminck and Schlegel, 1850.
 Thompson and Higgins, 1919.
 Tinker, 1944.
 Walford, 1931, 1937.

Neothunnus macropterus—Continued

Distribution

Abe, 1939.
 Anonymous, 1938.
 Barnhart, 1936.
 Bleeker, 1852, 1862, 1865a.
 Chapman, 1946.
 Chu, 1931.
 Delsman and Hardenburg, 1934.
 Domantay, 1940.
 Eckles, 1949a.
 FAO, 1949.
 Fish, 1948.
 Formosa Govt.-Gen. Fish. Expt. Sta., 1933a.
 Fowler, 1923a, 1928, 1931, 1938, 1949.
 Fraser-Brunner, 1950.
 Fujita and Wakiya, 1915.
 Godsil and Greenwood, 1948.
 Herre, 1932, 1935, 1936, 1940.
 Hildebrand, 1946.
 Hiratsuka and Imaizumi, 1934.
 Hiratsuka and Ito, 1934.
 Holder, 1912.
 Hubbs, 1916.
 Imaizumi, 1937.
 Japanese Bur. Fish., 1934.
 Jordan and Evermann, 1926a, 1926b.
 Jordan and Hubbs, 1925.
 Jordan and Jordan, 1922.
 Jordan and Seale, 1906.
 Jordan and Snyder, 1901.
 Jordan and Starks, 1907.
 Jordan, Tanaka, and Snyder, 1913.
 Kanamura and Imaizumi, 1935.
 Kanamura and Yazaki, 1940a, 1940b.
 Kimura, 1942b.
 Kishinouye, 1915a, 1923.
 Kōchi Pref. Fish. Expt. Sta., 1923b, -924.
 Kumata et al., 1941.
 Martin, 1938.
 Matsubara, 1943.
 Nakamura, 1939b, 1943, 1949.
 Okada and Matsubara, 1938.
 Okuma, Imaizumi, and Maki, 1935.
 Reeves, 1928.
 Richardson, 1846.
 Roedel, 1948b.
 Schaefer, 1948c.
 Seale, 1940.
 Serventy, 1941.
 Shapiro, 1948a, 1948b.
 Smith and Schaefer, 1949.
 Soldatov and Lindberg, 1930.
 South Seas Govt.-Gen. Fish. Expt. Sta., 1937a.
 Starks, 1918.
 Starks and Morris, 1907.
 Takao Prov. Fish. Expt. Sta., 1927.
 Tanaka, 1931.
 Taranetz, 1937.
 Temminck and Schlegel, 1850.

Neothunnus macropterus—Continued

Distribution—Continued

Tinker, 1944.
 Ulrey, 1929.
 Ulrey and Greeley, 1928.
 Walford, 1931, 1937.
 Whitley, 1928, 1947.
 Distribution correlated with water temperature
 Takayama and Ando, 1934.
 Uda, 1935a.
 Exploitation rates
 Tauchi, 1940b.
 Figured
 Anonymous, 1938.
 Barnhart, 1936.
 Delsman and Hardenburg, 1934.
 Domantay, 1940.
 Eckles, 1949a.
 Fraser-Brunner, 1950.
 Godsil and Byers, 1944.
 Jordan and Evermann, 1926b.
 Jordan and Starks, 1907.
 Kishinouye, 1915a, 1923.
 Kitahara, 1897.
 Kumata et al., 1941.
 Nakamura, 1949.
 Roedel, 1948b.
 Serventy, 1941.
 Shapiro, 1948a.
 Starks, 1918.
 Temminck and Schlegel, 1850.
 Tinker, 1944.
 Walford, 1931, 1937.
 Fishing conditions correlated with astronomical phenomena
 Takao Prov. Fish. Expt. Sta., 1927.
 Fishing conditions correlated with oceanography
 Aikawa, 1933.
 Ban, 1941.
 Formosa Govt.-Gen. Fish. Expt. Sta., 1933a.
 Hiratsuka and Imaizumi, 1934.
 Hiratsuka and Ito, 1934.
 Ikebe, 1940d, 1942.
 Inanami, 1940b, 1940c, 1941, 1942d.
 Japanese Bur. Fish., 1934.
 Kagoshima Pref. Fish. Expt. Sta., 1926b, 1927a, 1928b,
 1929b, 1930b, 1930c, 1931b, 1932b, 1933b.
 Kanamura and Imaizumi, 1935.
 Kanamura and Yazaki, 1940a, 1940b.
 Kawamura, 1939.
 Kimura, 1942a.
 Kimura and Ishii, 1933.
 Mie Pref. Fish. Expt. Sta., 1930c, 1930e.
 Nakamura, 1949.
 Ōita Pref. Fish. Expt. Sta., 1930.
 Okuma, Imaizumi, and Maki, 1935.
 Shapiro, 1948a.
 South Seas Govt.-Gen. Fish. Expt. Sta., 1937a, 1938,
 1941b, 1942, 1943b.
 Takao Prov. Fish. Expt. Sta., 1927.

Neothunnus macropterus—Continued

Fishing conditions correlated with oceanography—Con.

Takayama and Ando, 1934.

Uehara, 1941.

Fishing conditions correlated with weather

Formosa Govt.-Gen. Fish. Expt. Sta., 1933a.

Hiratsuka and Imaizumi, 1934.

Hiratsuka and Ito, 1934.

Kanamura and Yazaki, 1940a, 1940b.

Ōita Pref. Fish. Expt. Sta., 1930.

Okuma, Imaizumi, and Maki, 1935.

Food

Anonymous, 1938.

Ban, 1941.

Chapman, 1946.

Fitch, 1950.

Formosa Govt.-Gen. Fish. Expt. Sta., 1933a.

Herald, 1949.

Hildebrand, 1946.

Japanese Bur. Fish., 1934.

Kanamura and Imaizumi, 1935.

Kanamura and Yazaki, 1940a, 1940b.

Kishinouye, 1917b, 1923.

Marukawa, 1939.

Miyama, Saruya, and Hasegawa, 1939.

Nakamura, 1936, 1943, 1949.

Okuma, Imaizumi, and Maki, 1935.

Shapiro, 1948a.

Suyehiro, 1942.

Tinker, 1944.

Walford, 1937.

Growth

Aikawa and Kato, 1938.

Kimura, 1932, 1935.

Kishinouye, 1923.

Schaefer, 1948a, 1948b.

Habits

Kishinouye, 1923.

Nakamura, 1949.

Schaefer, 1948b.

Shapiro, 1948a.

Hormones

Migita and Arakawa, 1948.

Toyama et al., 1941.

Keys

Brock, 1949.

Delsman and Hardenburg, 1934.

Fraser-Brunner, 1950.

Godsil and Byers, 1944.

Hildebrand, 1946.

Jordan and Evermann, 1926b.

Kishinouye, 1915a, 1923.

Nakamura, 1949.

Okada and Matsubara, 1938.

Roedel, 1948b.

Serventy, 1941.

Soldatov and Lindberg, 1930.

Tarantetz, 1937.

Walford, 1931, 1937.

Neothunnus macropterus—Continued

Length-weight relation

Hiratsuka and Morita, 1935

Schaefer, 1948a.

Measurement data

Aikawa and Kato, 1938.

Anonymous, 1938.

Bonham, 1946.

Formosa Govt.-Gen. Fish. Expt. Sta., 1933a.

Godsil, 1948.

Godsil and Byers, 1944.

Higashi, 1940a, 1941b, 1941c, 1942.

Hiratsuka and Imaizumi, 1934.

Hiratsuka and Ito, 1934.

Ikebe, 1939, 1940a, 1940b, 1940c, 1941a, 1941b.

Inanami, 1940a.

Kanamura and Imaizumi, 1935.

Kanamura and Yazaki, 1940a, 1940b.

Marr, 1948.

Miyama, Saruya, and Hasegawa, 1939.

Nakamura, 1936, 1939a, 1939b.

Ōita Pref. Fish. Expt. Sta., 1925, 1927a, 1927b, 1930.

Okuma, Imaizumi, and Maki, 1935.

Schaefer, 1948a, 1948b.

South Seas Govt.-Gen. Fish. Expt. Sta., 1943a.

Watanabe, H., 1940.

Meristic characters

Godsil and Byers, 1944.

Migration

Kōchi Pref. Fish. Expt. Sta., 1923b, 1924.

Nakamura, 1943.

Shapiro, 1948a.

Tsuchi, 1940b.

Walford, 1937.

Parasites

Kishinouye, 1923.

Populations

Godsil, 1948, 1949.

Godsil and Byers, 1944.

Tsuchi, 1940b.

Reproduction

Hatai et al., 1941.

Ikebe, 1941b.

Kishinouye, 1923.

Marr, 1948.

Nakamura, 1939b, 1943, 1949.

Schaefer, 1948c.

Schaefer and Marr, 1948a.

Tinker, 1944.

Walford, 1937.

Sex ratio

Marr, 1948.

Miyama, Saruya, and Hasegawa, 1939.

Sexual maturity

Anonymous, 1938.

Ban, 1941.

Hatai et al., 1941.

Ikebe, 1939.

Imaizumi, 1937.

Kanamura and Imaizumi, 1935.

Neothunnus macropterus—Continued

Sexual maturity—Continued

Kanamura and Yazaki, 1940a, 1940b.

Kato, 1940.

Marr, 1948.

Okuma, Imaizumi, and Maki, 1935.

Schaefer, 1948b.

Schaefer and Marr, 1948a.

Size composition

Aikawa and Kato, 1938.

Kimura, 1932, 1942a.

Schaefer, 1948b.

Schaefer and Marr, 1948a.

Tsuchi, 1940b.

Survival rates

Tsuchi, 1940b.

Synonymy

Boeseman, 1947.

Chu, 1931.

FAO, 1949.

Fish, 1948.

Fowler, 1928, 1931, 1949.

Fraser-Brunner, 1950.

Herre, 1936.

Hildebrand, 1946.

Jordan and Hubbs, 1925.

Jordan and Starks, 1907.

Jordan, Tanaka, and Snyder, 1913.

Kishinouye, 1923.

Nakamura, 1939a, 1939b, 1949.

Richardson, 1846.

Soldatov and Lindberg, 1930.

Tanaka, 1931.

Ulrey and Greeley, 1928.

Tagging

Godsil, 1938.

Young

Kishinouye, 1924, 1926.

Schaefer, 1948c.

Schaefer and Marr, 1948a.

Neothunnus rarus

Anatomy

Kishinouye, 1915a, 1915b, 1923.

Nakamura, 1949.

Classification

Kishinouye, 1915a, 1923.

Nakamura, 1943, 1949.

Nichols and LaMonte, 1941.

Common names

Delsman and Hardenburg, 1934.

Kishinouye, 1915a, 1923.

Nakamura, 1943, 1949.

Nichols and LaMonte, 1941.

Compared with *Kishinoella tonggol*

Serventy, 1942b.

Description

Delsman and Hardenburg, 1934.

Kishinouye, 1915a, 1923.

Nakamura, 1949.

Nichols and LaMonte, 1941.

Neothunnus rarus—Continued

Distribution

Delsman and Hardenburg, 1934.

Herre, 1940.

Kishinouye, 1915a, 1923.

Nakamura, 1943, 1949.

Eggs

Delsman and Hardenburg, 1934.

Figured

Kishinouye, 1915a, 1923.

Nakamura, 1949.

Food

Kishinouye, 1923.

Nakamura, 1943, 1949.

Habits

Kishinouye, 1923.

Nakamura, 1949.

Keys

Delsman and Hardenburg, 1934.

Kishinouye, 1915a, 1923.

Nakamura, 1949.

Nichols and LaMonte, 1941.

Migration

Nakamura, 1943.

Reproduction

Delsman and Hardenburg, 1934.

Nakamura, 1943.

Synonymy

Kishinouye, 1923.

Nakamura, 1949.

Nichols and LaMonte, 1941.

Neothunnus rarus zacalles. See *Kishinoella zacalles*.*Neothunnus tonggol*

Description

Jordan and Evermann, 1926b.

Distribution

Jordan and Evermann, 1926b.

Keys

Jordan and Evermann, 1926b.

Synonymy

Jordan and Evermann, 1926b.

Neothunnus macropterus. See *Neothunnus macropterus*.

Nicotinic acid

Higashi and Hirai, 1948.

Nomenclature, tuna. See Tuna, common names.

Oceanographic conditions. See also Currents; Salinity;

Specific gravity; Tides; Water.

Correlated with fishing

Ban, 1941.

Formosa Govt.-Gen. Fish. Expt. Sta., 1933a.

Hiratsuka and Inaizumi, 1934.

Hiratsuka and Ito, 1934.

Ikebe, 1942.

Imamura, 1949.

Kanamura and Imaizumi, 1935.

Kanamura and Yazaki, 1940b.

Kawamura, 1939.

Kōchi Pref. Fish. Expt. Sta., 1923a.

Nakamura, 1949.

Oceanographic conditions—Continued

Correlated with fishing—Continued

Ōita Pref. Fish. Expt. Sta., 1930.
Okuma, Imaizumi, and Maki, 1935.
Scagel, 1949.
Shapiro, 1948a.

South Seas Govt.-Gen. Fish. Expt. Sta., 1937c, 1938,
1941b.

Taihoku Prov. Fish. Expt. Sta., 1927a, 1927b.
Uda, 1935b, 1940c.

Correlated with location of fishing grounds

Inanami, 1942a.
Soc. Prom. Ocean. Fish., 1936.

Orcynus. See *Thunnidae*.

Orcynus alalonga. See *Thunnus germo*.

Orcynus germo. See *Thunnus germo*.

Orcynus pacificus. See *Thunnus germo*.

Parasites

Bennett, 1840.
Harada, 1928.
Kishinouye, 1923.
Manter, 1940.
Van Cleave, 1940.

Parathunnus

Keys

Soldatov and Lindberg, 1930.

Parathunnus mebachi

Anatomy

Godsil and Byers, 1944.
Higashi, 1941c.
Kishinouye, 1915a, 1915b, 1918, 1919a, 1922a, 1923.
Nakamura, 1949.

Body temperature

Kanamura and Imaizumi, 1935.
Ōita Pref. Fish. Expt. Sta., 1927a, 1930.

Catch per unit of effort

Imaizumi, 1937.
Japanese Bur. Fish., 1939.
Kanamura and Imaizumi, 1935.
Kanamura and Yazaki, 1940a.
Nakamura, 1949.

Chemical analysis

Miyama and Osakabe, 1940.
Miyauchi, 1915.

Classification

Godsil and Byers, 1944.
Kishinouye, 1915a, 1923.
Nakamura, 1939b, 1943, 1949.

Common names

Kishinouye, 1915a, 1923.
Kumata et al., 1941.
Nakamura, 1939b, 1943, 1949.

Compared with *Neothunnus macropterus*

Roedel, 1948b.

Compared with *Thunnus germo*

Roedel, 1948b.

Description

Godsil and Byers, 1944.
Kishinouye, 1915a, 1923.
Nakamura, 1939b, 1949.

Parathunnus mebachi—Continued

Distribution

Fish, 1948.
Imaizumi, 1937.
Japanese Bur. Fish., 1934.
Kanamura and Imaizumi, 1935.
Kanamura and Yazaki, 1940a.
Kimura, 1942b.
Kishinouye, 1915a, 1923.
Kōchi Pref. Fish. Expt. Sta., 1923b, 1924.
Kumata et al., 1941.
Matsubara, 1943.
Nakamura, 1939b, 1943, 1949.
Takao Prov. Fish. Expt. Sta., 1927.

Distribution correlated with water temperatures

Takayama and Ando, 1934.

Figured

Godsil and Byers, 1944.
Kishinouye, 1915a, 1923.
Kumata et al., 1941.
Nakamura, 1949.

Fishing conditions correlated with astronomical phenomena

Takao Prov. Fish. Expt. Sta., 1927.

Fishing conditions correlated with oceanography

Aikawa, 1933.
Fukuda and Izuka, 1940a.
Ikebe, 1942.
Inanami, 1940b, 1940c, 1942d.
Japanese Bur. Fish., 1934, 1939.
Kagoshima Pref. Fish. Expt. Sta., 1926b, 1927a, 1928b,
1929b, 1930b, 1930c, 1931b, 1932b, 1933b.
Kanamura and Imaizumi, 1935.
Kimura, 1942a.
Mie Pref. Fish. Expt. Sta., 1930c, 1930e.
Nakamura, 1949.
Ōita Pref. Fish. Expt. Sta., 1930.
Okinawa Pref. Fish. Expt. Sta., 1940b.
Ōmori and Fujimoto, 1940.
Ōmori and Fukuda, 1938, 1940.
South Seas Govt.-Gen. Fish. Expt. Sta., 1942.
Takao Prov. Fish. Expt. Sta., 1927.
Takayama and Ando, 1934.
Uehara, 1941.

Fishing conditions correlated with weather

Kanamura and Imaizumi, 1935.
Ōita Pref. Fish. Expt. Sta., 1930.

Food

Kishinouye, 1917b, 1923.
Nakamura, 1943, 1949.

Habits

Kishinouye, 1923.
Nakamura, 1949.

Keys

Godsil and Byers, 1944.
Kishinouye, 1915a, 1923.
Nakamura, 1949.

Measurement data

Godsil and Byers, 1944.
Higashi, 1940a, 1941c.

Parathunnus mebachi—Continued

Measurement data—Continued

Ikebe, 1940a.

Kanamura and Imaizumi, 1935.

Ōita Pref. Fish. Expt. Sta., 1925, 1927a, 1927b, 1930.

Watanabe, H., 1940.

Meristic characters

Godsil and Byers, 1944.

Migration

Kōchi Pref. Fish. Expt. Sta., 1923b, 1924.

Nakamura, 1943.

Parasites

Kishinouye, 1923.

Reproduction

Nakamura, 1943.

Sexual maturity

Kanamura and Imaizumi, 1935.

Synonymy

Kishinouye, 1923.

Nakamura, 1939b, 1949.

Young

Hatai et al., 1941.

Kishinouye, 1926.

Young as food of tunas

Kishinouye, 1917b.

Parathunnus sibi

Anatomy

Suyehiro, 1941, 1942.

Chemical analysis

Miyama and Osakabe, 1938.

Classification

Okada and Matsubara, 1938.

Common names

Jordan and Hubbs, 1925.

Jordan and Snyder, 1901.

Okada and Matsubara, 1938.

Shapiro, 1948b.

Tinker, 1944.

Ulrey and Greeley, 1928.

Compared with *Pelamys sibi*

Bleeker, 1879.

Compared with *Thynnus alalunga*

Temminck and Schlegel, 1850.

Description

Brock, 1949.

Fowler, 1927, 1928.

Jordan and Evermann, 1926b.

Jordan and Hubbs, 1925.

Jordan and Jordan, 1922.

Okada and Matsubara, 1938.

Temminck and Schlegel, 1850.

Tinker, 1944.

Distribution

Domantay, 1940.

Fowler, 1927, 1928, 1929, 1931, 1938, 1949.

Herre, 1940.

Jordan and Evermann, 1926a, 1926b.

Jordan and Hubbs, 1925.

Jordan and Jordan, 1922.

Jordan and Snyder, 1901.

Parathunnus sibi—Continued

Distribution—Continued

Okada and Matsubara, 1938.

Richardson, 1846.

Shapiro, 1948b.

Smith and Schaefer, 1949.

Snyder, 1904.

Tanaka, 1931.

Tinker, 1944.

Ulrey, 1929.

Ulrey and Greeley, 1928.

Distribution correlated with water temperature

Uda, 1935a.

Figured

Domantay, 1940.

Fowler, 1927, 1928.

Jordan and Evermann, 1926b.

Kitahara, 1897.

Temminck and Schlegel, 1850.

Tinker, 1944.

Food

Suyehiro, 1942.

Habits

Brock, 1949.

Hormones

Toyama et al., 1941.

Keys

Brock, 1949.

Jordan and Evermann, 1926b.

Okada and Matsubara, 1938.

Measurement data

Brock, 1949.

Higashi, 1942.

Synonymy

Fowler, 1928, 1949.

Jordan and Evermann, 1926b.

Jordan and Hubbs, 1925.

Richardson, 1846.

Tanaka, 1931.

Ulrey and Greeley, 1928.

Young as food of tunas

Marukawa, 1939.

Parathynnus sibi. See *Parathunnus sibi*.*Pelamys affine*. See *Euthynnus alletteratus*.*Pelamys macropterus*. See *Neothunnus macropterus*.*Pelamys pelamys*. See *Katsuwonus pelamis*.*Pelamys sibi*Compared with *Thynnus sibi*

Bleeker, 1879.

Pelamys thunnina. See *Euthynnus alletteratus*.

Plecostei

Anatomy

Berg, 1947.

Kishinouye, 1917a.

Takahashi, 1924.

Classification

Berg, 1947.

Kishinouye, 1917a.

Takahashi, 1924, 1926.

Populations

- Aikawa, 1937.
 Brock, 1943.
 Clark, 1929.
 Godsil, 1948, 1949.
 Godsil and Byers, 1944.
 Imamura, 1949.
 Tauchi, 1940a, 1940b, 1940c, 1941.
 Tominaga, 1943.
 Uda and Tokunaga, 1937.
 Uda and Tsukushi, 1934.

Reproduction

- Brock, 1943.
 Delsman and Hardenburg, 1934.
 Eckles, 1949b.
 Hatai et al., 1941.
 Ikebe, 1941b.
 Imamura, 1949.
 Kishinouye, 1915a, 1923.
 Marr, 1948.
 Nakamura, 1938, 1939b, 1943, 1949.
 Schaefer, 1948c.
 Schaefer and Marr, 1948a.
 Serventy, 1941, 1942a.
 Shapiro, 1948b.
 Soc. Prom. Ocean. Fish., 1936.
 Tinker, 1944.
 Walford, 1937.
 Watanabe, H., 1939.
 Whitehead, 1931.
 Yabe and Mori, 1948.

Salinity. See also Oceanographic conditions.

Correlated with fishing

- Inanami, 1941.
 Uda and Tokunaga, 1937.

Scomber taso. See *Auxis taso*.*Semathunnus*

- Compared with *Neothunnus*
 Fowler, 1933.
 Nakamura, 1939a.

Semathunnus guildi

- Compared with *Neothunnus macropterus*
 Nakamura, 1939b.

Description

Fowler, 1933.

Distribution

Fowler, 1934.

Synonymy

Fowler, 1934.

Semathunnus itosibi

Common names

Tinker, 1944.

Description

Tinker, 1944.

Distribution

Fowler, 1934.

Tinker, 1944.

Synonymy

Fowler, 1934.

Sex. See Morphometrics.

Sexual maturity. See Maturity.

Size composition

- Aikawa, 1937.
 Aikawa and Kato, 1938.
 Brock, 1943.
 Hart et al., 1948.
 Inanami, 1942b.
 Kagoshima Pref. Fish. Expt. Sta., 1937.
 Kawana, 1934.
 Kida, 1936.
 Kimura, 1932, 1935, 1941, 1942a.
 Mine and Iehisa, 1940.
 Nakamura Res. Staff, 1949.
 Okamoto, 1940.
 Sasaki, 1939a, 1939b.
 Scagel, 1949.
 Schaefer, 1948b.
 Schaefer and Marr, 1948a.
 Serventy, 1941, 1947.
 Tauchi, 1940a, 1940b, 1940c.
 Uda, 1935b.
 Uda and Tsukushi, 1934.
 Yabe and Mori, 1948.

Skipjack. See *Katsuwonus pelamis*.Skipjack, black. See *Euthynnus* spp.

Spawning. See Reproduction.

Specific gravity

Correlated with fishing

- Formosa Govt.-Gen. Fish. Expt. Sta., 1930, 1931,
 1932, 1933b, 1934.
 Japanese Bur. Fish., 1939, 1940.
 Mie Pref. Fish. Expt. Sta., 1930a, 1930b, 1930c, 1930d,
 1930e.
 Ōmori and Fujimoto, 1940.
 Ōmori and Fukuda, 1938, 1940.
 Shimamura, 1927.
 Taihoku Prov. Fish. Expt. Sta., 1929.

Stock. See Populations.

Stomach contents. See Food.

Survival rates

- Tauchi, 1940a, 1940b, 1940c.

Synonymy

- Bleeker, 1852, 1856.
 Boeseman, 1947.
 Chevey, 1932a, 1934.
 Chu, 1931.
 Evermann and Seale, 1907.
 FAO, 1949.
 Fish, 1948.
 Fowler, 1904b, 1928, 1931, 1934, 1938, 1944, 1949.
 Fraser-Brunner, 1949, 1950.
 Griffin, 1927.
 Günther, 1860, 1876.
 Herre, 1936.
 Hildebrand, 1946.
 Jenkins, 1903.
 Jordan, 1923.
 Jordan and Evermann, 1896, 1905, 1926b.
 Jordan and Gilbert, 1882.

Synonymy—Continued

- Jordan and Hubbs, 1925.
 Jordan and Starks, 1907.
 Jordan, Tanaka, and Snyder, 1913.
 Kishinouye, 1923.
 Lütken, 1880.
 McCulloch, 1922.
 Meek and Hildebrand, 1923.
 Nakamura, 1939a, 1939b, 1949.
 Nichols and LaMonte, 1941.
 Phillipps, 1927b.
 Powell, 1937.
 Richardson, 1846.
 Schultz, 1949.
 Schultz and DeLacy, 1936.
 Serventy, 1942b.
 Soldatov and Lindberg, 1930.
 Tanaka, 1912, 1931.
 Ulrey and Greeley, 1928.
 Wade, 1949.
 Waite, 1907, 1921.
 Weber, 1913.
 Whitley, 1937.

Tagging

- Anonymous, 1939.
 Fukuda and Iizuka, 1940b.
 Godsil, 1938.
 Kagoshima Pref. Fish. Expt. Sta., 1928a, 1936b, 1938b,
 1939b, 1940b.
 Kawana, 1934.
 Matsumoto, 1937.
 Scagel, 1949.
 South Seas Govt.-Gen. Fish. Expt. Sta., 1941c.
 Uda, 1936.

Temperature. See Body temperature; Water temperature; also Oceanographic conditions.

Thunnidae

Anatomy

- Kishinouye, 1917a, 1919a.

Classification

- Jordan, 1923.
 Kishinouye, 1917a.
 Lütken, 1880.

Distribution

- Bleeker, 1844.

Keys

- Jordan and Hubbs, 1925.

Synonymy

- Jordan, 1923.
 Lütken, 1880.

Thunniformes. See Plecostei.

Thunnus alalunga. See *Thunnus germo*.

Thunnus albacora. See *Neothunnus macropterus*.

Thunnus germo

Age

- Aikawa and Kato, 1938.
 Brock, 1943.
 Ikebe, 1940c.
 Kanamura and Yazaki, 1940b.
 Kimura, 1942a.

Thunnus germo—Continued

Age—Continued

- Tauchi, 1940c.
 Uno, 1936b.

Anatomy

- Bennett, 1840.
 Fish, 1948.
 Godsil and Byers, 1944.
 Kishinouye, 1915a, 1915b, 1919a, 1922a, 1923.
 Nakamura, 1949.
 Suyehiro, 1941.

Body condition

- Aikawa and Kato, 1938.
 Kanamura and Yazaki, 1940b.
 Soc. Prom. Ocean. Fish., 1936.

Body temperature

- Anonymous, 1938.
 Kanamura and Yazaki, 1940b.
 Ōita Pref. Fish. Expt. Sta., 1927a.
 Scagel, 1949.

Catch per unit of effort

- Imaizumi, 1937.
 Japanese Bur. Fish., 1939, 1940.
 Kanamura and Yazaki, 1940a, 1940b.
 Nakamura, 1949.

Chemical analysis

- Dill, 1921.
 Miyauchi, 1915.
 Soc. Prom. Ocean. Fish., 1936.

Classification

- Fraser-Brunner, 1950.
 Godsil and Byers, 1944.
 Kishinouye, 1915a, 1923.
 Nakamura, 1939b, 1943, 1949.
 Okada and Matsubara, 1938.
 Phillipps, 1927b.
 Roedel, 1948b.
 Shapiro, 1948a.
 Soldatov and Lindberg, 1930.
 Taranetz, 1937.
 Walford, 1931.

Common names

- Barnhart, 1936.
 Craig, 1929.
 FAO, 1949.
 Fish, 1948.
 Fujita and Wakiya, 1915.
 Herre and Umali, 1948.
 Jordan and Evermann, 1896, 1905.
 Jordan and Hubbs, 1925.
 Jordan, Tanaka, and Snyder, 1913.
 Kishinouye, 1915a, 1923.
 Nakamura, 1939b, 1943, 1949.
 Okada and Matsubara, 1938.
 Phillipps, 1927b.
 Roedel, 1948b.
 Serventy, 1941.
 Shapiro, 1948a, 1948b.
 Smith, 1947.
 Starks and Morris, 1907.

Thunnus germo—Continued

Common names—Continued

- Tinker, 1944.
 Ulrey and Greeley, 1928.
 Walford, 1931, 1937.

Compared with *Parathunnus mebachi*

- Roedel, 1948b.

Description

- Barnhart, 1936.
 Bennett, 1840.
 Boeseman, 1947.
 Clemens and Wilby, 1946.
 Cooper, 1863.
 Cuvier and Valenciennes, 1831.
 Fowler, 1904b, 1928.
 Fraser-Brunner, 1950.
 Godsil and Byers, 1944.
 Griffin, 1927.
 Günther, 1860, 1876.
 Jordan and Evermann, 1905, 1926b.
 Jordan and Hubbs, 1925.
 Jordan and Jordan, 1922.
 Kishinouye, 1915a, 1923.
 Meek and Hildebrand, 1923.
 Nakamura, 1939b, 1949.
 Okada and Matsubara, 1938.
 Roedel, 1948b.
 Serventy, 1941.
 Shapiro, 1948a.
 Soldatov and Lindberg, 1930.
 Starks, 1918.
 Stead, 1906.
 Tinker, 1944.
 Walford, 1931, 1937.

Distribution

- Anonymous, 1938.
 Barnhart, 1936.
 Brock, 1939.
 Clemens and Wilby, 1946.
 Cooper, 1863.
 Cowan, 1938.
 Cuvier and Valenciennes, 1831.
 Eigenmann, 1892.
 Eigenmann and Eigenmann, 1891.
 FAO, 1949.
 Fish, 1948.
 Fowler, 1904a, 1923b, 1928, 1931, 1938, 1944.
 Fraser-Brunner, 1950.
 Fujita and Wakiya, 1915.
 Gilbert and Starks, 1904.
 Godsil and Greenhood, 1948.
 Griffin, 1927.
 Günther, 1860, 1876.
 Herre, 1940.
 Hildebrand, 1946.
 Holder, 1912.
 Hubbs, 1928.
 Imaizumi, 1937.
 Japanese Bur. Fish., 1939, 1940.
 Jordan, 1885.

Thunnus germo—Continued

Distribution—Continued

- Jordan and Evermann, 1896, 1905, 1926a, 1926b.
 Jordan and Gilbert, 1881a, 1882.
 Jordan and Hubbs, 1925.
 Jordan and Jordan, 1922.
 Jordan and Seale, 1906.
 Jordan, Tanaka, and Snyder, 1913.
 Kanamura and Yazaki, 1940b.
 Kimura, 1942b.
 Kishinouye, 1915a, 1923.
 Kōchi Pref. Fish. Expt. Sta., 1923b, 1924.
 Matsubara, 1943.
 McCulloch, 1922.
 Meek and Hildebrand, 1923.
 Metz, 1912.
 Nakamura, 1939b, 1943, 1949.
 Okada and Matsubara, 1938.
 Phillipps, 1927a, 1927b.
 Phillipps and Hodgkinson, 1922.
 Roedel, 1948b.
 Roughly, 1916.
 Sampson, 1940.
 Schaefer, 1948c.
 Schultz and DeLacy, 1936.
 Serventy, 1941, 1947.
 Shapiro, 1948a, 1948b.
 Soldatov and Lindberg, 1930.
 Starks, 1918.
 Starks and Morris, 1907.
 Stead, 1906, 1908.
 Tanaka, 1931.
 Taranetz, 1937.
 Thompson and Higgins, 1919.
 Tinker, 1944.
 Ulrey, 1929.
 Ulrey and Greeley, 1928.
 Walford, 1931, 1937.
 Whitehead, 1929.
 Distribution correlated with water temperature
 Takayama and Ando, 1934.
 Uda, 1935a.

Eggs

- Watanabe, H., 1939.

Enemies

- Bennett, 1840.

Exploitation rates

- Tauchi, 1940c.

Figured

- Anonymous, 1938.
 Barnhart, 1936.
 Clemens and Wilby, 1946.
 Cooper, 1863.
 Fowler, 1904a.
 Fraser-Brunner, 1950.
 Godsil and Byers, 1944.
 Griffin, 1927.
 Günther, 1876.
 Holder, 1912.
 Jordan and Evermann, 1905, 1926b.

Thunnus germon—Continued

Figured—Continued

- Kishinouye, 1915a, 1923.
 Kitahara, 1897.
 Nakamura, 1949.
 Roedel, 1948b.
 Serventy, 1941.
 Shapiro, 1948a.
 Tinker, 1944.
 Walford, 1931, 1937.

Fishing conditions correlated with area

- Hart and Hollister, 1947.
 Hart et al., 1948.

Fishing conditions correlated with oceanography

- Aikawa, 1933.
 Chiba Pref. Fish. Expt. Sta., Katsuura Br., 1936, 1941.
 Hart and Hollister, 1947.
 Hart et al., 1948.
 Inanami, 1942d.
 Japanese Bur. Fish., 1939, 1940.
 Kagoshima Pref. Fish. Expt. Sta., 1927a, 1928b, 1930b,
 1930c, 1931b, 1932b, 1932c, 1933b.
 Kanamura and Yazaki, 1940b.
 Kimura, 1942a, 1949.
 Mie Pref. Fish. Expt. Sta., 1930c, 1930e.
 Nakamura, 1949.
 Sasaki, 1939b.
 Scagel, 1949.
 Shapiro, 1948a.
 Takayama and Ando, 1934.
 Uda, 1940c.
 Uda and Tokunaga, 1937.

Fishing conditions correlated with season

- Hart et al., 1948.

Fishing grounds correlated with oceanography

- Soc. Prom. Ocean. Fish., 1936.

Food

- Anonymous, 1938.
 Asano, 1939.
 Bennett, 1840.
 Clemens and Wilby, 1946.
 Hart and Hollister, 1947.
 Hart et al., 1948.
 Japanese Bur. Fish., 1939, 1940.
 Jordan and Gilbert, 1881b, 1882.
 Kanamura and Yazaki, 1940b.
 Kishinouye, 1917b, 1923.
 Kuronuma, 1940.
 Nakamura, 1943, 1949.
 Scagel, 1949.
 Shapiro, 1948a.
 Starks, 1918.
 Starks and Morris, 1907.
 Walford, 1937.
 Watanabe, H., 1939.

Growth

- Aikawa and Kato, 1938.
 Brock, 1943.
 Kishinouye, 1923.

Thunnus germon—Continued

Habits

- Jordan and Gilbert, 1882.
 Kishinouye, 1923.
 Nakamura, 1949.
 Shapiro, 1948a.

Hormones

- Toyama et al., 1941.

Keys

- Brock, 1949.
 Fraser-Brunner, 1950.
 Godsil and Byers, 1944.
 Hildebrand, 1946.
 Jordan and Evermann, 1926b.
 Kishinouye, 1915a, 1923.
 McCulloch, 1922.
 Meek and Hildebrand, 1923.
 Nakamura, 1949.
 Okada and Matsubara, 1938.
 Roedel, 1948b.
 Serventy, 1941.
 Soldatov and Lindberg, 1930.
 Taranetz, 1937.
 Walford, 1931, 1937.

Measurement data

- Aikawa and Kato, 1938.
 Anonymous, 1938.
 Brock, 1943.
 Godsil, 1948.
 Godsil and Byers, 1944.
 Ikebe, 1940c.
 Japanese Bur. Fish., 1939, 1940.
 Kanamura and Yazaki, 1940b.
 Ōita Pref. Fish. Expt. Sta., 1925, 1927a.
 South Seas Govt.- Gen. Fish. Expt. Sta., 1943a.
 Uno, 1936b.
 Watanabe, H. 1939.

Meristic characters

- Clark, 1929.
 Godsil and Byers, 1944.

Migration

- Cobb, 1919.
 Kimura, 1942b.
 Kishinouye, 1923.
 Kōchi Pref. Fish. Expt. Sta., 1923b, 1924.
 Nakamura, 1943, 1949.
 Sasaki, 1939b.
 Shapiro, 1948a.
 Soc. Prom. Ocean. Fish., 1936.
 Walford, 1937.

Populations

- Brock, 1943.
 Clark, 1929.
 Godsil, 1943, 1949.
 Godsil and Byers, 1944.
 Tauchi, 1940c.
 Uda and Tokunaga, 1937.

Reproduction

- Brock, 1943.
 Nakamura, 1948.

Thunnus germo—Continued

Reproduction—Continued

- Schaefer, 1948c.
 Soc. Prom. Ocean. Fish., 1936.
 Walford, 1937.
 Watanabe, H., 1939.

Sex ratio

- Brock, 1943.

Sexual maturity

- Anonymous, 1938.
 Clark, 1929.
 Kanamura and Yazaki, 1940b.
 Soc. Prom. Ocean. Fish., 1936.
 Watanabe, H., 1939.

Size composition

- Aikawa and Kato, 1938.
 Brock, 1943.
 Hart et al., 1948.
 Kimura, 1942a.
 Sasaki, 1939b.
 Scagel, 1949.
 Tauchi, 1940c.

Survival rates

- Tauchi, 1940c.

Synonymy

- Boeseman, 1947.
 FAO, 1949.
 Fish, 1948.
 Fowler, 1904b, 1923.
 Fraser-Brunner, 1950.
 Griffin, 1927.
 Günther, 1860, 1876.
 Jordan and Evermann, 1896, 1905, 1926b.
 Jordan and Gilbert, 1882.
 Jordan and Hubbs, 1925.
 Jordan, Tanaka, and Snyder, 1913.
 Kishinouye, 1923.
 McCulloch, 1922.
 Meek and Hildebrand, 1923.
 Nakamura, 1939b, 1949.
 Phillipps, 1927b.
 Schultz and DeLacy, 1936.
 Soldatov and Lindberg, 1930.
 Tanaka, 1931.
 Ulrey and Greeley, 1928.

Tagging

- Scagel, 1949.

Young

- Kishinouye, 1917b, 1919b, 1923.
 Lüttken, 1880.
 Schaefer, 1948c.

Thunnus maccori. See *Thunnus maccoyi*.

Thunnus maccoyi

- Catch per unit of effort
 Serventy, 1947.

Classification

- Roughly, 1916.

Common names

- Serventy, 1941.
 Whitley, 1947.

Thunnus maccoyi—Continued

- Compared with *Kishinoella tonggol*
 Serventy, 1941.

Description

- Castelnau, 1872.
 Jordan and Evermann, 1926b.
 Macleay, 1881.
 Roughly, 1916.
 Serventy, 1941.
 Stead, 1908.

Distribution

- Jordan and Evermann, 1926b.
 Lord, 1927.
 Macleay, 1881.
 McCulloch, 1922.
 Roughly, 1916.
 Serventy, 1941, 1947.
 Stead, 1908.
 Waite, 1928.
 Whitley, 1947.

Figured

- McCulloch, 1922.
 Roughly, 1916.
 Serventy, 1941.

Habits

- Roughly, 1916.

Keys

- Jordan and Evermann, 1926b.
 McCulloch, 1922.
 Serventy, 1941.

Length-weight relation

- Serventy, 1941.

Migration

- Serventy, 1941.

Reproduction

- Serventy, 1941.

Size composition

- Serventy, 1941, 1947.

Synonymy

- Jordan and Evermann, 1926b.
 McCulloch, 1922.

Thunnus macropterus. See *Neothunnus macropterus*.

Thunnus maculatus

Distribution

- Holder, 1912.

Figured

- Holder, 1912.

Thunnus mebachi. See *Parathunnus mebachi*.

Thunnus nicolsoni

- Compared with *Kishinoella tonggol*
 Serventy, 1942b.

Thunnus obesus. See also *Parathunnus mebachi* and *Parathunnus sibi*.

Classification

- Fraser-Brunner, 1950.

Description

- Fraser-Brunner, 1950.

Distribution

- Fraser-Brunner, 1950.

Thunnus obesus—Continued

Figured

Fraser-Brunner, 1950.

Keys

Fraser-Brunner, 1950.

Synonymy

Fraser-Brunner, 1950.

Thunnus orientalis

Age

Aikawa and Kato, 1938.

Kimura, 1935.

Tauchi, 1940a.

Anatomy

Kishinouye, 1915a, 1915b, 1919a, 1921, 1922a, 1923.

Migita and Arakawa, 1948.

Nakamura, 1938, 1949.

Suyehiro, 1942.

Body condition

Aikawa and Kato, 1938.

Body temperature

Ōita Pref. Fish. Expt. Sta., 1927a, 1930.

Chemical analysis

Miyama and Osakabe, 1938, 1940.

Miyachi, 1915.

Shimizu, 1947.

Classification

Kishinouye, 1915a, 1923.

Nakamura, 1939b, 1943, 1949.

Okada and Matsubara, 1938.

Shapiro, 1948a.

Common names

Fujita and Wakiya, 1915.

Jordan and Hubbs, 1925.

Jordan and Snyder, 1901.

Kishinouye, 1915a, 1923.

Nakamura, 1939b, 1943, 1949.

Okada and Matsubara, 1938.

Shapiro, 1948a, 1948b.

Tinker, 1944.

Compared with *Thunnus thynnus*

Kishinouye, 1921.

Soc. Prom. Ocean. Fish., 1936.

Tinker, 1944.

Description

Boeseman, 16.

Jordan and Evermann, 1926b.

Jordan and Hubbs, 1925.

Jordan and Jordan, 1922.

Kishinouye, 1915a, 1923.

Nakamura, 1939b, 1949.

Okada and Matsubara, 1938.

Shapiro, 1948a.

Temminck and Schlegel, 1850.

Tinker, 1944.

Distribution

Fowler, 1934.

Fujita and Wakiya, 1915.

Jordan and Evermann, 1926a, 1926b.

Jordan and Hubbs, 1925.

Jordan and Jordan, 1922.

Thunnus orientalis—Continued

Distribution—Continued

Jordan and Snyder, 1900, 1901.

Kimura, 1942b.

Kishinouye, 1915a, 1923.

Kōchi Pref. Fish. Expt. Sta., 1924.

Matsubara, 1943.

Mori, 1928.

Nakamura, 1938, 1939b, 1943, 1949.

Okada and Matsubara, 1938.

Reeves, 1928.

Richardson, 1846.

Shapiro, 1948a, 1948b.

Tinker, 1944.

Distribution correlated with water temperature

Takayama and Ando, 1934.

Eggs

Hatai et al., 1941.

Nakamura, 1938, 1949.

Enemies

Kishinouye, 1923.

Exploitation rates

Tauchi, 1940a.

Figured

Kishinouye, 1915a, 1923.

Nakamura, 1939b, 1949.

Otaki, Fujita, and Higurashi, 1903.

Shapiro, 1948a.

Tinker, 1944.

Fishing conditions correlated with astronomical phenomena

Kawana, 1934.

Fishing conditions correlated with oceanography

Aikawa, 1933.

Fukuda and Iizuka, 1940a.

Iehisa, 1939.

Kagoshima Pref. Fish. Expt. Sta., 1927a, 1930c, 1932b.

Kawana, 1934, 1937.

Mie Pref. Fish. Expt. Sta., 1930c, 1930e.

Ōita Pref. Fish. Expt. Sta., 1930.

Okinawa Pref. Fish. Expt. Sta., 1940b.

Ōmori and Fujimoto, 1940.

Ōmori and Fukuda, 1938, 1940.

Shapiro, 1948a.

Takayama and Ando, 1934.

Uda, 1940c.

Fishing conditions correlated with weather

Ōita Pref. Fish. Expt. Sta., 1930.

Food

Kishinouye, 1923.

Nakamura, 1943, 1949.

Shapiro, 1948a.

Suyehiro, 1942.

Growth

Aikawa and Kato, 1938.

Kimura, 1932.

Kishinouye, 1923.

Habits

Kishinouye, 1923.

Nakamura, 1949.

Shapiro, 1948a.

Thunnus orientalis—Continued

Hormones

Migita and Arakawa, 1948.

Keys

Brock, 1949.

Jordan and Evermann, 1926b.

Kishinouye, 1915a, 1923.

Nakamura, 1949.

Okada and Matsubara, 1938.

Measurement data

Aikawa and Kato, 1938.

Higashi, 1940a.

Ōita Pref. Fish. Expt. Sta., 1927a, 1930.

Migration

Kimura, 1942b.

Kishinouye, 1923.

Kōchi Pref. Fish. Expt. Sta., 1924.

Nakamura, 1943, 1949.

Shapiro, 1948a.

Populations

Tauchi, 1940a.

Reproduction

Hatai et al., 1941.

Kishinouye, 1915a; 1923.

Nakamura, 1938, 1939b, 1943, 1949.

Soc. Prom. Ocean. Fish., 1936.

Sexual maturity

Hatai et al., 1941.

Nakamura, 1938.

Size composition

Aikawa and Kato, 1938.

Kawana, 1934.

Kimura, 1932, 1935.

Mine and Iehisa, 1940.

Tauchi, 1940a.

Survival rates

Tauchi, 1940a.

Synonymy

Boeseman, 1947.

Fowler, 1934.

Jordan and Evermann, 1926b.

Jordan and Hubbs, 1925.

Kishinouye, 1923.

Nakamura, 1939b, 1949.

Richardson, 1846.

Tagging

Kawana, 1934.

Young

Kishinouye, 1919b, 1923.

Thunnus philippisi

Classification

Phillipps, 1927b.

Common names

Phillipps, 1927b.

Description

Jordan and Evermann, 1926b.

Distribution

Jordan and Evermann, 1926b.

Phillipps, 1927b.

Figured

Jordan and Evermann, 1926b.

Thunnus orientalis—Continued

Keys

Jordan and Evermann, 1926b.

Synonymy

Phillipps, 1927b.

Thunnus philippisi. See *Thunnus philippisi*.

Thunnus rarus. See *Neothunnus rarus*.

Thunnus saliens

Common names

Craig, 1929.

Description

Jordan and Evermann, 1926b.

Distribution

Jordan and Evermann, 1926b.

Ulrey, 1929.

Figured

Jordan and Evermann, 1926b.

Keys

Jordan and Evermann, 1926b.

Thunnus schlegelii. See *Thunnus orientalis*.

Thunnus thunmina. See *Euthynnus alletteratus*.

Thunnus thynnus. See *Thunnus thynnus*.

Thunnus thynnus

Anatomy

Fish, 1948.

Godsil and Byers, 1944.

Kishinouye, 1921.

Catch per unit of effort

Whitehead, 1931.

Chemical analysis

Dill, 1921.

Classification

Fraser-Brunner, 1950.

Godsil and Byers, 1944.

Roedel, 1948b.

Soldatov and Lindberg, 1930.

Taranetz, 1937.

Walford, 1931.

Whitehead, 1931.

Common names

Barnhart, 1936.

FAO, 1949.

Fish, 1948.

Jordan and Evermann, 1896.

Jordan, Tanaka, and Snyder, 1913.

Roedel, 1948b.

Schultz, 1949.

Starks and Morris, 1907.

Tinker, 1944.

Ulrey and Greeley, 1928.

Walford, 1931, 1937.

Compared with *Neothunnus macropterus*

Thompson and Higgins, 1919.

Compared with *Thunnus orientalis*

Kishinouye, 1921.

Soc. Prom. Ocean. Fish., 1936.

Tinker, 1944.

Description

Barnhart, 1936.

Fowler, 1928, 1944.

Fraser-Brunner, 1950.

Thunnus thynnus—Continued

Description—Continued

- Godsil and Byers, 1944.
 Günther, 1876.
 Meek and Hildebrand, 1923.
 Roedel, 1948b.
 Soldatov and Lindberg, 1930.
 Starks, 1918.
 Stead, 1906.
 Tinker, 1944.
 Walford, 1931, 1937.

Distribution

- Abe, 1939.
 Barnhart, 1936.
 Brock, 1938.
 FAO, 1949.
 Fish, 1948.
 Fowler, 1923a, 1923b, 1928, 1929, 1931, 1934, 1938,
 1944.
 Fraser-Brunner, 1950.
 Gilbert and Starks, 1904.
 Günther, 1876.
 Herre, 1936, 1940.
 Hildebrand, 1946.
 Holder, 1912.
 Jordan and Evermann, 1896.
 Jordan and Jordan, 1922.
 Jordan, Tanaka, and Snyder, 1913.
 Meek and Hildebrand, 1923.
 Metz, 1912.
 Roedel, 1948b.
 Schultz, 1949.
 Schultz and DeLacey, 1936.
 Soldatov, 1929.
 Soldatov and Lindberg, 1930.
 Starks, 1918.
 Starks and Morris, 1907.
 Stead, 1906.
 Tanaka, 1931.
 Taranetz, 1937.
 Tinker, 1944.
 Ulrey, 1929.
 Ulrey and Greeley, 1928.
 Waite, 1921.
 Walford, 1931, 1937.
 Whitehead, 1929, 1931.

Distribution correlated with water temperature

Uda, 1935a.

Enemies

- Tinker, 1944.
 Walford, 1937.

Figured

- Barnhart, 1936.
 Fraser-Brunner, 1950.
 Godsil and Byers, 1944.
 Holder, 1912.
 Kitahara, 1897.
 Roedel, 1948b.
 Soldatov and Lindberg, 1930.
 Starks, 1918.
 Tinker, 1944.

Thunnus thynnus—Continued

Figured—Continued

- Walford, 1931, 1937.
 Whitehead, 1931.
 Fishing conditions correlated with oceanography
 Kida, 1936.
 Food
 Tinker, 1944.
 Walford, 1937.
 Habits
 Kida, 1936.
 Uchida, 1923.

Keys

- Brock, 1949.
 Fraser-Brunner, 1950.
 Godsil and Byers, 1944.
 Hildebrand, 1946.
 Meek and Hildebrand, 1923.
 Roedel, 1948b.
 Soldatov and Lindberg, 1930.
 Taranetz, 1937.
 Walford, 1931, 1937.

Measurement data

- Godsil and Byers, 1944.
 Uda, 1932.

Meristic characters

- Godsil and Byers, 1944.

Migration

- Whitehead, 1931.

Populations

- Godsil and Byers, 1944.

Reproduction

- Tinker, 1944.
 Walford, 1937.
 Whitehead, 1931.

Size composition

- Kida, 1936.

Synonymy

- FAO, 1949.
 Fish, 1948.
 Fowler, 1928, 1934, 1944.
 Fraser-Brunner, 1950.
 Günther, 1876.
 Herre, 1936.
 Jordan and Evermann, 1896.
 Jordan, Tanaka, and Snyder, 1913.
 Meek and Hildebrand, 1923.
 Schultz, 1949.
 Schultz and DeLacey, 1936.
 Soldatov and Lindberg, 1930.
 Tanaka, 1931.
 Ulrey and Greeley, 1928.
 Waite, 1921.

Thunnus tonggol

Classification

- Fraser-Brunner, 1950.

Compared with *Kishinoella tonggol*.

- Serventy, 1942b.

Description

- Bleeker, 1852.

Thunnus tonggol—Continued

Description—Continued

Fraser-Brunner, 1950.
Günther, 1860.

Distribution

Bleeker, 1852, 1861b.
Fraser-Brunner, 1950.
Günther, 1860.

Figured

Fraser-Brunner, 1950.
Serventy, 1942b.

Keys

Fraser-Brunner, 1950.

Synonymy

Bleeker, 1852.
Fraser-Brunner, 1950.
Günther, 1860.

Thunnus zacalles. See *Kishinoella zacalles*.

Thynnus. See *Thunnidae*.

Thynnus affinis. See *Euthynnus alletteratus*.

Thynnus alalonga. See also *Thynnus germo*.

Compared with *Thynnus sibi*
Temminck and Schlegel, 1850.

Thynnus germo. See *Thynnus germo*.

Thynnus maccoyi. See *Thynnus maccoyi*.

Thynnus macropterus. See *Neothynnus macropterus*.

Thynnus orientalis. See *Thynnus orientalis*.

Thynnus pacificus. See *Thynnus germo*.

Thynnus pelamys. See *Katsuwonus pelamis*.

Thynnus sibi. See *Parathynnus sibi*; also *Thynnus germo*.

Thynnus thunina. See *Euthynnus alletteratus*.

Thynnus thunina. See *Euthynnus alletteratus*.

Thynnus thynnus. See *Thynnus thynnus*.

Thynnus tonggol. See *Thynnus tonggol*.

Tides. See also Oceanographic conditions.

Correlated with fishing

Takao Prov. Fish. Expt. Sta., 1927.

Transparency, water. See Water transparency; also Oceanographic conditions.

Tuna

Bibliography

Corwin, 1930.

Chemical analysis

Kodama, Iizuka, and Harada, 1934.
Tomiyama, 1933.

Common names

Australian

Serventy, 1941.
Whitley, 1947.

English

Barnhart, 1936.
Craig, 1929.
Fish, 1948.
Herre and Umali, 1948.
Jordan and Evermann, 1896.
Kumata et al., 1941.
Nichols and LaMonte, 1941.
Roedel, 1948b.
Schultz, 1949.
Starks and Morris, 1907.

Tuna—Continued

Common names—Continued

English—Continued

Tanaka, 1912.
Tinker, 1944.
Ulrey and Greeley, 1928.
Walford, 1931, 1937.

European

Kumata et al., 1941.
Tinker, 1944.

Hawaiian

Jordan and Evermann, 1905.
Jordan and Jordan, 1922.
Smith, 1947.
Tinker, 1944.

Indo-Chinese

Chevey, 1932a.

Japanese

Fish, 1948.
Fujita and Wakiya, 1915.
Jordan and Evermann, 1926b.
Jordan and Hubbs, 1925.
Jordan and Metz, 1913.
Jordan and Snyder, 1901.
Jordan, Tanaka, and Snyder, 1913.
Kishinouye, 1915a, 1923.
Kumata et al., 1941.
Nakamura, 1939b, 1943, 1949.
Okada and Matsubara, 1938.
Shapiro, 1948a.
Tanaka, 1912.
Tinker, 1944.
Tominaga, 1943.

Malayan

Delsman and Hardenburg, 1934.
Kumata et al., 1941.

Maori

Phillipps, 1927b.

Micronesian

Smith, 1947.

New Zealand

Phillipps, 1927b.

Peruvian

Nichols and Murphy, 1922.

Philippine

Herre and Umali, 1948.

Ryukyuan

Shapiro, 1948b.

Venezuelan

Schultz, 1949.

Worldwide

FAO, 1949.

Distribution

Hasegawa, 1937.
South Seas Govt.-Gen. Fish. Expt. Sta., 1937b, 1941a.

Food

Kishinouye, 1895, 1915a.

Habits

Kishinouye, 1915a.

Measurement data

Kodama, Iizuka, and Harada, 1934.

Wanderer wallisi

Classification

Whitley, 1937.

Compared with *Euthynnus alletteratus*

Whitley, 1937.

Compared with *Euthynnus yuito*

Whitley, 1937.

Description

Whitley, 1937.

Food

Whitley, 1937.

Synonymy

Whitley, 1937.

Water. See also Oceanographic conditions.

Color correlated with fishing

Inanami, 1940c.

Taihoku Prov. Fish. Expt. Sta., 1929, 1932.

Temperature

Correlated with body temperature

Nakamura, 1941.

Ōita Pref. Fish. Expt. Sta., 1927a, 1930.

Correlated with distribution

Takayama and Ando, 1934.

Takayama, Ikeda, and Ando, 1934.

Correlated with fishing conditions

Aikawa, 1933.

Chiba Pref. Fish. Expt. Sta., Katsuura Br., 1936, 1937, 1938, 1941.

Formosa Govt.-Gen. Fish. Expt. Sta., 1930, 1931, 1932, 1933b, 1934.

Fukuda and Iizuka, 1940a.

Hart and Hollister, 1947.

Hart et al., 1948.

Iehisa, 1939.

Inanami, 1941, 1942d.

Japanese Bur. Fish., 1934, 1939, 1940.

Kagoshima Pref. Fish. Expt. Sta., 1925, 1926a, 1926b, 1927a, 1927b, 1928a, 1928b, 1929a, 1929b, 1930a, 1930b, 1930c, 1931a, 1931b, 1932a, 1932b, 1932c, 1933a, 1933b, 1935, 1936a, 1937.

Kanamura and Yazaki, 1940a.

Kawana, 1937.

Kida, 1936.

Kimura, 1941, 1942a, 1949.

Kimura and Ishii, 1933.

Kumamoto Pref. Fish. Expt. Sta., 1946.

Mie Pref. Fish. Expt. Sta., 1930a, 1930b, 1930c, 1930d, 1930e.

Okinawa Pref. Fish. Expt. Sta., 1940a, 1940b, 1943.

Ōmori and Fujimoto, 1940.

Ōmori and Fukuda, 1938, 1940.

Sasaki, 1939a, 1939b.

Shizuoka Pref. Fish. Expt. Sta., 1936, 1937.

South Seas Govt.-Gen. Fish. Expt. Sta., 1942, 1943b.

Taihoku Prov. Fish. Expt. Sta., 1929, 1932.

Takayama and Ando, 1934.

Takayama, Ikeda, and Ando, 1934.

Uda, 1935a, 1935b, 1936, 1938, 1939, 1940b, 1940c.

Uda and Tokunaga, 1937.

Water—Continued

Temperature—Continued

Correlated with fishing conditions—Continued

Uehara, 1941.

Yabe and Mori, 1948.

Transparency correlated with fishing

Inanami, 1942a.

Japanese Bur. Fish., 1934.

Weather

Correlated with fishing

Formosa Govt.-Gen. Fish. Expt. Sta., 1933a.

Hiratsuka and Imaizumi, 1934.

Hiratsuka and Ito, 1934.

Iehisa, 1939.

Kanamura and Imaizumi, 1935.

Ōita Pref. Fish. Expt. Sta., 1930.

Okinawa Pref. Fish. Expt. Sta., 1940a, 1943.

Okuma, Imaizumi, and Maki, 1935.

Taihoku Prov. Fish. Expt. Sta., 1927a, 1927b.

Uda and Watanabe, 1938.

Yellow-finned tuna. See *Neothynnus macropterus*.

Young

As food of tunas

Eckles, 1949b.

Kishinouye, 1917b.

Marukawa, 1939.

Description

Delsman, 1931.

Delsman and Hardenburg, 1934.

Eckles, 1949b.

Günther, 1889.

Kagoshima Pref. Fish. Expt. Sta., 1926a, 1927b.

Kishinouye, 1919b, 1923, 1924, 1926.

Lütken, 1880.

Marr, 1948.

Schaefer and Marr, 1948a, 1948b.

Wade, 1949.

Figured

Eckles, 1949b.

Günther, 1889.

Kishinouye, 1919b, 1923, 1926.

Lütken, 1880.

Schaefer and Marr, 1948a, 1948b.

Wade, 1949.

Records of capture

Delsman, 1931.

Delsman and Hardenburg, 1934.

Eckles, 1949b.

Günther, 1889.

Hatai et al., 1941.

Inanami, 1942c.

Kagoshima Pref. Fish. Expt. Sta., 1926a, 1927b.

Kishinouye, 1919b, 1923, 1924, 1926.

Lütken, 1880.

Marr, 1948.

Schaefer, 1948c.

Schaefer and Marr, 1948a, 1948b.

Wade, 1949.

Yabe and Mori, 1948.